73 AMATEUR RADIO

$1.00
NOVEMBER 1974

DIGITAL
SWR COMPUTER

K2OAW
COUNTER UPDATE

HOW TO WIN
A BIG CONTEST

2M
SYNTHESIZER

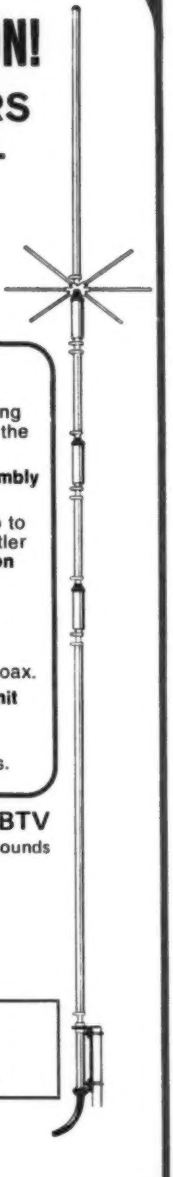
WIND–PROOF
20M BEAM

DIGITAL
WIND INDICATOR

K1CLL
6M PREAMPLIFIER

AND MUCH,
MUCH MORE

BARRY GOLDWATER, K7UGA,
LOVES TO CHEW THE FAT



HUSTLER®

4-BTV THRIVES ON COMPARISON!

FOUR BAND—40 THRU 10 METERS FIXED STATION TRAP VERTICAL

Whether you want—

- one setting for total band coverage
- extra weight and high mechanical strength
- easy assembly and installation

—or just plain performance and reliability—

Hustler is the verified choice!

PERFORMANCE AND MECHANICAL SPECIFICATIONS

- **Lowest SWR**—PLUS!
- Bandwidth at its **broadest!** SWR 1.6 to 1 or better at band edges.
- Hustler exclusive trap covers **"Spritz" extruded** to otherwise unattainable close tolerances assuring accurate and permanent trap resonance.
- Solid one inch **fiberglass trap forms** for optimum electrical and mechanical stability.
- Extra heavy duty aluminum mounting bracket with **low loss—high strength** insulators.
- All sections **1¼" heavy wall,** high strength aluminum. Length 21'5".
- **Stainless steel clamps** permitting adjustment without damage to the aluminum tubing.
- Guaranteed to be **easiest assembly** of any multi-band vertical.
- Antenna has ⅜"-24 stud at top to accept RM-75 or RM-75-S Hustler resonator for **75 meter operation** when desired.
- Top loading on 75 meters for broader bandwidth and **higher radiation efficiency!**
- Feed with **any length** 50 ohm coax.
- Power capability—**full legal limit** on SSB and CW.
- Ground mount with or without radials; roof mount with radials.

MODEL 4-BTV
WGT. 15 pounds

Buy Hustler . . . buy the verified choice of thousands!

Available from all distributors
who recognize the best!

new-
tronics
corporation

15800 commerce park drive,
brook park, ohio 44142

Exporter: Roburn Agencies, Inc., New York, N.Y.

#170 NOVEMBER 1974

73 AMATEUR RADIO

FEATURES

2 Never Say Die W2NSD/1
3 Looking West
4 SSTV Scene
6 AMSAT
6 Traveling Ham
6 Novice
8 Guest Editorial
8 Book Review
9 50 MHz Band
9 Ham Help
9 Social Events
10 Repeater Update
12 News
14, 139, 141, 144 Letters
16 QSL Contest
16 Hamburgler
17 Solid State
42 Emergency Ferrite Beads
64 Rf Hot Dog
72 Tool and Time Saver
74 Heat Sinks from Scrap
94 An Emergency Transformer
106 Jacking the Gal. Trans.
136 Grrreen
138 Vox Poop
138 U.K. Recip. Lic.
138 Long Wave Club
140 Caveat Emptor
142 Circuits, Circuits
166 Propagation

COVER STORY: An inside look at the club whose members spent so many dedicated hours completing phone patches for airmen overseas. Senator Barry Goldwater, above, is one of its members.

CONTENTS

20 Dipole Antenna Tuning WA4RSX
26 Latest Counter Update K2OAW
36 Who Needs A 5V Supply? WA0ABI
37 How To Win A Big Contest VK4SS
40 Digital Wind Direction Indicator W2AOO
44 Build A 2M Frequency Synthesizer W8KBC
66 Experiment in Terror WA9VLK
67 A Wind-Proof 20M Beam VE7DKR
71 Tones and How to Touch Them K1NUN
73 The Double Stub Matching System WA6CPP
75 How You Can Teach Novices WA9NJZ
80 Build This Digital SWR Computer W6OTG
88 A Real Hot Front End For Six K1CLL
95 Build A Basic Bridge WA0ABI
97 MOSKEY – Part III W3HPX
105 August 73 Converter Update W0LMD
108 Beep – Beep – Beep – Beep, You're High W2OC
116 What's Really Inside The Regency HT? W3WTO
124 Would You Believe 187,000 Phone Patches? .. K7NZA

73 Magazine is published monthly by 73, Inc., Peterborough, New Hampshire 03458. Subscription rates are $7 for one year in North America and U.S. Zip Code areas overseas, $8 per year elsewhere. Two years $12 and $13 overseas. Three years, $15, and $16 overseas. Second class postage paid at Peterborough, New Hampshire 03458 and at additional mailing offices. Phone: 603-924-3873. Microfilm edition of 73 available from University Microfilms, Ann Arbor MI 48106. Magnetic tapes available from Science for the Blind, 332 Rock Hill Rd., Bala Cynwyd PA 19904. *Entire contents copyright 1974 by 73 Inc., Peterborough, NH 03458.*

73 Staff

EDITOR/PUBLISHER
Wayne Green

MANAGING EDITOR
Stuart Norwood

ASSOCIATES
Schley Cox WN9LHO
Tom DiBiase WB8KZD
Terry Fox WB4JFI
Mike Frye WB8LBP
Dave Ingram K4TWJ
Joe Kasser G3ZCZ/W3
Bill Pasternak WA2HVK/6
John Schultz W2EEY
Waller Scott K8DIZ
Bill Turner WA0ABI

PRODUCTION
Lenore DeLigouri
Carol Dostilio
Bill Heydolf
Biff Mahoney
Lynn Panciera-Fraser
Bob Sawyer
Rod Tulonen
Barbara Walker

ADVERTISING
Bill Edwards WB6BED/1
Karen Hebert

BUSINESS
Knud E. Keller KV4GG/1

MARKETING
David A. Behnke

CIRCULATION
Barbara Block
Dorothy Gibson
Diane Grophear

TRANSPORTATION
Bill Barry
Paul Krulis

DRAFTING
T. M. Graham W8FKW
Bill Morello
Wayne Peeler K4MVK

NEVER SAY DIE

...de W2NSD/1

EDITORIAL BY WAYNE GREEN

PAYING THE FREIGHT

Inflation is doing fine, as you know. In the ham rag business we notice the frequent increases in paper prices, printing prices, postage and salaries for staffers who go to the A&P expecting to say WeeeO, but instead say WOW!

Our subscription rates will inch up a tad, but this isn't enough. We can't raise our advertising rates too much without hurting all of those small companies who depend heavily on 73 to bring them customers.

After a lot of thought – and figuring that a page of ads in 73 will pay for almost three pages of articles and news – the obvious solution was to encourage non-ham advertisers to help pick up the tab. Since most hams wear pants, the Haband ad last month seemed like a good start – and we are very familiar with their amazingly good clothes. We think the Haband pants and shoes are one of the best bargains around, possibly with the exception of the 73 subscription rate.

The advertising department is working on a few more surprises like that, all of which means a thicker magazine for you and a lot more articles. Oddly enough, the cost of reaching prospective customers via 73 is incredibly low – much lower than most companies in other fields believe is possible. This may have something to do with our running the magazine from one of the United States' low rent districts.

ANTENNA GADGETEERS ARISE

Not since the olden days when Sam Harris (W8UKS and W1FZJ) was playing around with his 75m bi-square beams has much been done to develop gain on that band – at least as far as the work resulting in any articles of value to antenna experimenters.

The fact is that during these unsunspot days quite a few of us would be interested in some antenna info for the lower bands. Has anyone been working on this? Perhaps someone has tried out a twin-three antenna on 75m? Let's see some work on this and some articles.

I remember all too well how Sam used to work all over the world on 75m with 50 watts and his bi-square – and how my kilowatt and dipole was quite a few dB down in South Africa and Europe. It seems like some new work *must* have been done in the last twenty–five years on antennas for 75m.

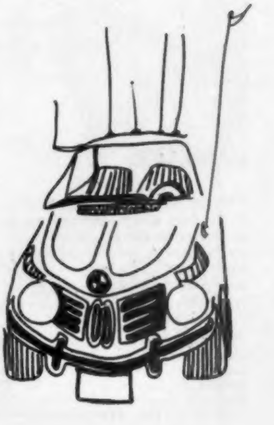
ARTICLES WANTED

A newspaper clipping sent in by reader Joecks from up in Vermont tells about a chap who has hooked up his phone so he can turn on his air conditioning by remote control. Hmmm. Seems this chap uses a Touchtone pad and has thirty different things he can do by remote control. Why anyone would want to turn on his television set by remote control is probably not worth a lot of consideration – the reason is probably simple – just to be able to do it.

The ham applications are many (obviously) and I think a few of the 73 readers might like to whomp up something like this, if there are any builders out there with more time and ICs than they need to do a minimum while waiting out their lives.

Some of us would like to be able to call home and tone on the 2m rig and monitor the local channel – maybe even be able to call in and casually describe the process, with just that right sigh of slight boredom.

Tell you what – you build up the gadget and we'll print the article. And you think up the clever applications.



Looking West

Bill Pasternak WA2HVK/6
14725 Titus St. #4
Panorama City CA 91402

In a recent T.V. Guide interview, F.C.C. Chairman Richard Wiley stated that he was opposed to unnecessary regulation of the broadcast media. Based on some of the newly proposed legislation regarding amateur radio, it is becoming obvious that Commissioner Wiley and the FCC are really listening to us and that his opposition to unnecessary regulation is being extended to us also. Therefore, if no one else has said it yet, a hearty thank you Chairman Wiley from those of us who make up the amateur radio community.

Some of the legislation I speak of, which by the time you read this may have been enacted, was released in docket form on July 25 as dockets number 20112 and 20113 respectively. 20112 deals with permitting automatic remote control of amateur repeaters while 20113 is designed to ease restrictions against cross – band operation of repeaters. The latter is based on a petition filed by the ARRL (RM 2337) while the former, 20112 can in good part be credited to hard work on the part of the Southern California Association and especially its Vice – Chairman Dick McKay K6VGP.

Late in 1973, Dick approached the F.C.C. for permission to experiment with a control system on the repeater's input channel. In January of this year, Dick was granted a six month "Special Temporary Authorization" to experiment with a semi-automatic remote control system on his two repeaters WR6AAD and WR6AAE. It took very little time to prove that the concept was both valid and viable. But AAD and AAE are sub-audible tone access repeaters with limited membership. Could this same system work on a heavily populated open system? A short time ago Fred Deeg K6AEH repeater trustee for the Palisades Amateur Radio Club, applied for and was granted an STA to experiment with a fully automatic remote control system on the input to the club repeater WR6ABB. It was felt that the PARC machine with over half the club's membership using it daily plus a large number of non club members also communicating on it would make for an ideal test bed. Without being long winded about it, it worked perfectly! Based on this dual success, Dick prepared a petition asking that Part 97 be amended "To allow for the definition and operation of automatically remote controlled repeater stations"; doing so in the name of the Southern California Repeater Association. Shortly thereafter, 20112 was released and while it does not mention either Dick or the SCRA by name, it does thank those amateurs and organizations that experimented with semi-automatic and fully automatic remote control systems. Unless I miss my guess, we here in L.A. are those amateurs they are talking about. Dick, Fred and the rest of the SCRA have put in many long hours on this project, not just for those of us out here but for all of you. When 20112 is finally enacted it will be a giant step forward in providing again that round-the-clock operation that makes the amateur repeater one of the most valuable aspects of amateur radio.

Five days after 20112 was released your reporter flat on his back in Ceders-Sinai Medical Center – Mt. Sinai Hospital recovering from an attack of kidney stones; the seventh time in the same number of years. Now while no one likes to go to the hospital, least of all yours truly, there are times when these things cannot be avoided. However, Ceders-Sinai is unlike any other hospital I have ever been in and if ever the need arises again it is the place I will pick. They seem to believe if you treat a patient as a guest, carefully cater to a patient's needs promptly and most important keep the atmosphere cheerful, a person will recover a lot more quickly. From first hand experience I can tell you that it works, and works well. Most important to me, the food they served was not just good but better than many restaurants I have frequented. As to medical attention, it was the finest I have ever received and everyone on the staff went out of his or her way to make me as comfortable as possible. This then is my personal thank-you to those fine men and women who helped me recover so quickly, and to Denny WA6LVO for loaning me his KP202 HT to keep HVK/6 on-the-air while there.

A number of friends suggested that I get away for a few days to recuperate. My physician gave me a green light as long as I was back in time for some tests. Since Sharon's mom and dad were visiting from New York we decided to make Las Vegas our destination. Though I have been there a number of times in the past, I always flew there via Air-West and never had a radio with me. This time we drove and were never out of range of a repeater, a comforting thought when you cross the Mojave Desert and it's about 110 degrees outside. Since I live in the San Fernando Valley it was faster for us to head north on the San Diego Freeway (I-405) to the Newhall area and head out the newly completed Antelope Valley Freeway (Cal. 14). Heading out of town we QSO'd the AM rush-hour crowd on the WR6ABE Mt. Wilson Repeater (147.435 – 146.40) though once in the hills along 14 it was spotty. About 20 miles west of Palmdale we lost ABE completely. As we came down out of the hills and approached the Palmdale area we were able to access the .16 – .76 Table Mountain Machine located near Barstow. As we soon learned, WR6AFB does cover a large section of the Southern California Desert area along I-15 and Cal. 58. We were able to use it from Palmdale, through Mojave, Barstow finally loosing it while going through Mountain Pass at better than 4,000 feet, descending the eastern side. Scanning the eight available channels in my Sonar 3601, I came across a QSO on .28 – .88. Not having anything to add to the QSO, I just SWL'ed it into Las Vegas proper. Arriving at our hotel, we went QRT for the rest of the day. Since this was an overnight one day venture we were on the road the next morning. We found a machine on .34 – .94 and after a short QSO there went back to .28 – .88 and worked some stations there that filled us in on what machine covers what area of Las Vegas. .28 – .88 is the home of WR7ADZ, part of the famous Gronk Radio Network. Sitting atop Mt. Potosi, ADZ has almost phenominal coverage extending from St. George, Utah to the northeast and San Bernadino, California to the southwest. A quick look at a roadmap will give you a better idea of ADZ's coverage than my description here. I also personally can verify coverage to the southwest at least as far as the Cajon Pass on the return trip. Now that's what I call coverage!

WR7AEH on .34 – .94 is the local coverage machine designed for in town coverage. I found it could be accessed as long as the "Strip" was in sight from I-15. There are also two other machines in the Las Vegas area I was told. The .07 – .67 repeater covers north Las Vegas and a machine on 147.18 – 147.84 covers the western area. Due to lack of proper crystals I was unable to use these latter machines. WR7AEH is operated by the Las Vegas Radio Amateur Club while the two other machines are privately owned. All machines are open carrier squelch and judging from those I worked while there, the Las Vegas area repeaters are inhabited by a friendly bunch of amateurs.

Well, the shows were great, and I made it home with the shirt still on my back. In fact I even came out a couple bucks ahead! Most of all, it was the kind of fun I needed to help forget the previous three weeks. Good old New York may call itself *Fun City*, but Las Vegas is also deserving of that same title. At least in my book.

de WA2HVK/6

SSTV SCENE

Dave Ingram K4TWJ
Rte. 11, Box 499, Eastwood Vil. 50N
Birmingham AL 35210

Is Slow Scan TV Dying?

Some serious questions have been raised on Slow Scan TV lately which deserve our utmost consideration. Is SSTV interest dwindling? Why are we not hearing more activity on the air? Is it a result of recently poor band conditions that seemingly isolate various SSTVers around the world or are newcomers merely replacing older enthusiasts who become bored due to the lack of interesting material on the air? Is SSTV interest great enough to attract commercial manufacturers or will they, like some others, fall by the wayside? We know many SSTVers are involved with experimentation more than actual operation because each years' knowledge gain is twice the previous year. We can scan convert pictures on *both ends* of a QSO, ASC II Typewrite messages on a SSTV screen, exchange color pictures and even span continents with these pictures. However, a means of communication is only as good as its use. More imaginative *operators* would be enthusiastically received on the air. Let's all try to work up more interesting pictures (if one picture is worth a thousand words, let's prove it!) and recruit more SSTV operators. Operators with gear ready to move in time of emergency can prove SSTV's full capabilities. Bring your thoughts out on the air. . .send me your comments. Let's not allow SSTV to fall into the "way out group" category by doing like so many people today. . .reading this, then forgetting it. Do so and SSTV will surely fade out.

Newcomers

Newcomers can now get started in Slow Scan TV quite easily. Used monitors are periodically appearing for around $200, the same price as many 2 meter rigs. Through Slow Scan TV you can see various places around the world, swap circuits over the air or see those items of interest many hams have. Does 2 meters offer this kind of excitement or do you find it fun to hear the same people say the same things every day.

An excellent way to get started in Slow Scan TV is the W6MXV kit unit which is available from Mike Tallant for around 100 to 150 dollars, depending on your junkbox. This unit is tops. Mike's detailed instructions, neat P.C. boards, X-Ray plans, etc., make it easier to construct than Heath gear! I built much of mine by carrying the boards with me, adding parts in my spare time and then soldering the connections at night. Recently I forwarded one of these kits down to WA2ZDF/CP1. Mike is really doing them up neat now. . .nice packing, large plans, gosh, it even includes the sync tuning tube! I don't know how he manages to break even on the kits.

Want to know more about what countries are on SSTV? Look over the following list of contacts from one of the DX leaders, Jack VE3GMT. There are around 90 countries presently on SSTV which means DXCC isn't far off. It's looking like the first certificates will be going to VE3GMT, W8YEK and W4MS. Any other challengers? What's your DXCC/SSTV total?

DJ0CN	W. Germany
EA4DT	Spain
EA8CI	Canaries
EL2CB	Liberia
ET3DS	Ethiopia
F6AXT	France
FG7XT	Guadeloupe
FM7WW	Martinique
FO8DO	French Oc.
G3RHI	England
GC3YIZ	Guernsey
GI3NBB	N. Ireland
GW3DZJ	Wales
HA7LF	Hungary
HB9IT	Switzerland
HB0NL	Liechtenstein
HK3CF	Colombia
HR2HH	Honduras
I1BNT	Italy
IS1PEM	Sardinia
JA7FS	Japan
W4YK	U.S.A.
KC4DX	Navassa
KC4USX	Antartica
KH6HJF	Hawaii
KL7HAB	Alaska
KP4GN	P. Rico
KV4CM	Virgins
KX6DR	Marshalls
LA2BK	Norway
LU7AAG	Argentina
OD5HC	Lebanon
OE6GC	Austria
OK1NH	Czech
ON5SV	Belgium
OX3LP	Greenland
OY1M	Faroes
OZ4IP	Denmark
PA0LAM	Netherlands
PJ2CU	Antilles
PY1DCB	Brazil
PZ1DX	Surinam
SM0BUO	Sweden
VK5MF	Australia
VP2AR	Antigua
VP2ME	Monserrat
K4GXO/VP7	Bahamas
VP9GR	Bermuda
VQ9R	Seychelles
VU25KV	India
XE1JM	Mexico
YN3RBD	Nicaragua
YU2CDS	Yugoslavia
YU5AJ	Venezuela
ZF1TV	Cayman
ZC1AOY	N. Zealand
ZS6PP	S. Africa
ZS3B	S.W. Africa
4X4TW	Israel
6Y5GB	Jamaica
8RIW	Guyana
9K2AM	Kuwait
9Q5BG	Zaire
9X5PB	Rawanda
9Y4VU	Trinidad

Late additions into SSTV:

OA4F
HZ1SH
YU2CDS
DU1SS
OH2KT
JY8AA
9V1RA
W6AXE/KG6
AP2AD
VK9XX

Incidentally, you don't need an expensive rig to work SSTV: 90 percent of the DX stations show on 20 meters exclusively. A single bander SSB rig and, if you like, a single band homebrew linear amplifier are quite sufficient.

Scan Converter

Several Slow Scanners have asked how Slow-to-Fast Scan converted pictures look and if there are any simple shortcuts for accomplishing the same results. Not really! However a simple "visual coupler" could be constructed using an inexpensive closed circuit (Fast Scan) camera which has a "channel" rf output and your present SSTV monitor. Place the camera to view your Slow Scan monitor screen, then adjust contrast and brightness for optimum results. A hood or light-tight enclosure between camera lens and monitor screen would be advantageous in brightly illuminated rooms. Next, feed the camera's rf output to

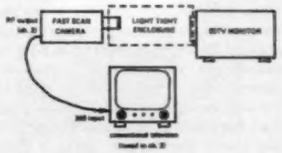
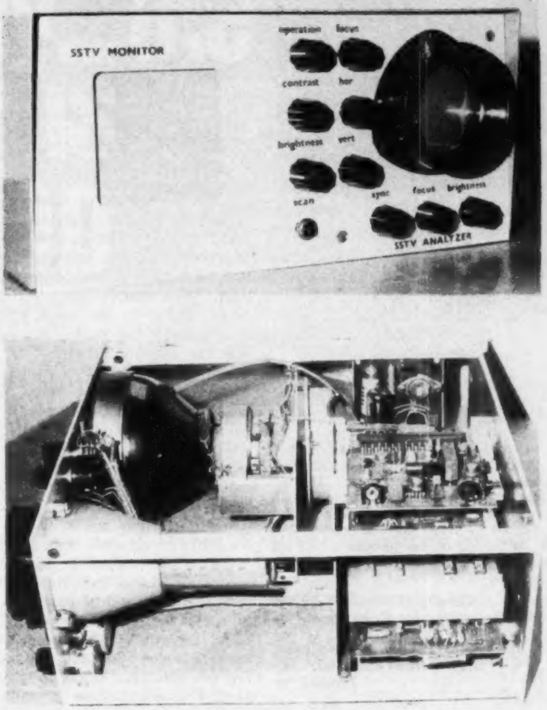


Fig. 1. Simple "Visual Coupler" SSTV converter.



Front panel and interior view of OK2PAD's homebrew monitor. Note the outstanding workmanship.

your regular TV and you can view large, bright pictures. Nice, eh?

Slow Scan TV activity in Czechoslovakia appears on the upswing, as reported by Franta, OK100. There are approximately 15 stations presently active on SSTV, with around 35 more interested and due to have gear going soon. The more active stations include OK1GW, OK3ZAS, OK2BNE and OK100. Their most popular frequency is 14.230 kHz. Although "Telsa" is their only manufacturer and IC availability is limited, transistors are rather plentiful. Shift Register memories are presently not available. Prices are high compared to our standards (would you work 7 or 8 hours to afford 3 or 4 simple ICs?) so amateurs must have a genuine interest before indulging in a SSTV venture. Their main SSTV cathode ray tubes are similar to our 5FP7 and use numbers like 13LM31, 25QP21 and 180QQ86. The first numbers appear to designate screen size in centimeters. Most of the fellows live some distance apart and work dilligently building their gear to reduce unnecessary components. OK3ZAS and OK2BNE, for example, are getting good results from the W7ABW camera while using regular vidicons.

This month's pictures are of OK2PAD's homebrew monitor and reveal outstanding workmanship. The unit uses a 13LM31 and much modified W6MXV circuit. Two emitter coupled transistors replace a CA3028 IC and sweep circuits are similar to W9LUO design. A W0LMD type video analyzer is included on the unit's right. The single tube visible behind the c.r.t. yoke is the high voltage rectifier.

A while back, Jack VE3GMT, suggested a monthly newsletter on SSTV. Interested parties could send info to him and he would get this out to all active SSTVers. He never received any letters! Come on now, aren't you proud of your accomplishments? How long does it take to scribble a short note? We are going to that same idea in this column, so drop me a card now on your new gear, DX worked, planned modifications or whatever. I'll get this right into the next month's column so we all will know more about "what's happening."

... **K4TWJ**

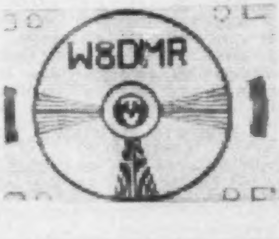
Exciting New Type of TV Tube

W.E. Parker W8DMR
2738 Floribunda Dr.
Columbus, Ohio 43209

I believe this is the first amateur television test pattern reproduced by the new solid state self-scanning image sensor. The sensor is a 100 by 100 element charged coupled device (CCD). Instead of the conventional vidicon camera tube employed in generating television pictures, a Fairchild CCD-201 was used. The 10,000 element self-scanning image sensor is mounted in a 24 lead dual-in-line package with an optical glass window. I believe the CCD's impact on TV cameras can be considered analogous to that of the transistor on vacuum tubes.

The image sensing elements are 1.2 mils by 0.8 mils located on 1.2 mil vertical centers and 1.6 horizontal centers. The light sensitive area is a 100 by 100 array of photo elements which provide an image aspect ratio of 4 by 3. In addition, the image sensing chip includes 100 columns of two-phase shift registers interdigitated among; the photo elements, a 102 unit two-phase analog output shift register, an output preamplifier, and a compensation amplifier. Charge coupled devices are a new class of semiconductor structures. When arrays of 512 by 512 elements are commercially available, the resolution wedges on the test pattern will be distinct from the outer circle to the inner circle.

... **W8DMR**



AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr
Dayton OH 45429

AMSAT-OSCAR-B before final thermal-vacuum testing of the spacecraft. The ten-meter antenna (provided by Amatek-Hunter Spring), and 2304 MHz quadrifilar antenna (furnished by RCA Astro-Electronics Div.) are on the top of the spacecraft. With the spacecraft is Elizabeth, XYL of WA3LND.

Oscar 6 orbiting information for November.

Orbit	Date (Nov.)	Time (GMT)	Longitude of Eq. Crossing °W
4775	1	0008.7	49.8
4788	2	0103.6	63.5
4800	3	0003.5	48.5
4813	4	0058.5	62.2
4826	5	0153.4	76.0
4838	6	0053.3	61.0
4851	7	0148.3	74.7
4863	8	0048.2	59.7
4876	9	0143.1	73.4
4888	10	0043.1	58.4
4901	11	0138.0	72.1
4913	12	0037.9	57.1
4926	13	0132.9	70.9
4938	14	0032.8	55.8
4951	15	0127.7	69.6
4963	16	0027.7	54.6
4976	17	0122.6	68.3
4988	18	0022.5	53.3
5001	19	0117.4	67.0
5013	20	0017.4	52.0
5026	21	0112.3	65.7
5038	22	0012.2	50.7
5051	23	0107.2	64.4
5063	24	0007.1	49.4
5076	25	0102.0	63.2
5088	26	0002.0	48.1
5101	27	0056.9	61.9
5114	28	0151.8	75.6
5126	29	0051.8	60.6
5139	30	0146.7	74.3

ANSWER TO LAST MONTH'S CRYPTOGRAM

Secret message from kindly editor: Shape up or else! Tell the damned FCC what you think re proposed regs.

The TRAVELING Ham

Joe Kasser G3ZCZ
1701 East West Highway, Apt. 205
Silver Spring MD 20910

Have you heard or worked those ubiquitous Italian stations on 20 meters lately? What do you think of those stations who proceed to spell out their name, which is ten letters long, phonetically, twice or three times, and then the name of their town, which has twenty letters and then say "seventy threes"?

Do you realize that they are holding the QSO in what is to them a foreign language? Could you do the same, say hold a QSO in Italian or Spanish.

Italy has a very competent amateur radio set up. The national club is called the Associazione Radiotecnica Italiana, and they put out a very fine monthly magazine called Radio Rivista. The magazine contains a number of original technical articles as well as the occasional translated one from Radio Communication or from QST. It is full of advertisements for Yaesu, Drake, Gladding, Standard, Ten-Tec, Clegg and locally built equipment. Rigs are available for both FM and SSB on two meters, a band that is planned for mode sharing, with calling frequencies, RTTY frequencies and FM channels. The Clegg FM-27B is also sold covering the range of 144-146MHz. The published address of the ARI is: Via Domenico Scarlatti 31, 20124 Milano, Italy. Tel 203192.

Although Italy does not yet have a reciprocal agreement with the USA, it does have one with the countries comprising the European Common Market. So if you get a permit from one of these countries you may be able to get an Italian permit using one of your other reciprocal permits. It's not so complicated as it sounds, for there is an ON8. ./W on the air from the USA, and ON8 is the "call are" allocated to foreign residents or visitors under the reciprocal agreements with Belgium. It must be explained though that this ON8 is a native of Belgium but received his first ham license in France and was subsequently issued with an ON8 call. I've also heard a WN call signing Portable From South America on twenty meter phone, so strange things happen in the world of overseas operations.

For those intending to visit Italy on the most useful two meter frequencies are the calling channel on 145.5MHz and the International calling Channel on 145.55MHz. There is also an SSB calling channel on 144.2MHz. There is a lot of activity on SSB and in the summer, DX contacts can be made over the Mediterranean Sea. If you are taking a qrp hf rig, you might consider adding a grp transverter module as described in vhf communications magazine. This unit would be advantageous in most European countries because a lot of mobile activity is on SSB using commercial equipment.

Does anybody read this column and if so what would you like it to cover? Reader response has been abismal lately and, if nobody reads this column then I might as well turn the space back to Wayne to fill with something of more interest to you readers.

. . . G3ZCZ/W3

novice

Schley Cox WN9LHO
219 Kilgore Avenue
Muncie IN 47305

WHAT DO YOU SAY?

At 0011 GMT the other night I called a WN8 in answer to his CQ. I didn't get a chance to give him his 479C signal report because he answered my call with a too lengthy preamble and then sent "QRM 73 CUL" and then signed off the air. At 0015 I logged an end to my shortest contact on record outside the Novice Roundup.

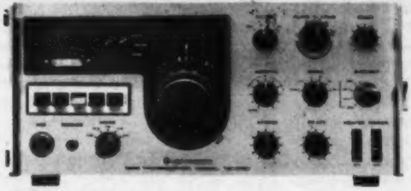
I know that sometimes we get on the air and the dinner call suddenly comes 30 minutes early or the envelope starts to melt on the final amplifier tube, but I have a suspicion that sometimes the super short contact is due to one or both operators having nothing to say.

Tradition has saved some new ops from mike fright by dictating that the RST, QTH and name be sent on the first transmission; the rig and antenna on the second; and finally, heart warming 73s and fervent CUL's on the third and last.

This is unfortunate unless there is a distinct need for brevity — e.g., contests, traffic or emergencies. There is a lot to talk about even at 5 wpm. I like to know something about who I am talking to on the air. How old is the other person, what does he (or she) do for a living, how many states has he

suddenly...the answer is KENWOOD

Today when you ask "How can I modernize my SSB operation?", the answer certainly is KENWOOD. The deluxe TS-900 transceiver, the superb, go-anyplace TS-520 transceiver and the versatile R-599A receiver and T-599A transmitter offer today's amateur advanced design, reliable solid-state performance, contemporary styling... and the cost is modest. Now more than ever the answer is KENWOOD.



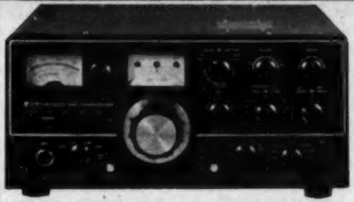
TS-900

Kenwood's superb state-of-the-art SSB transceiver

. . . the ultimate transceiver. The promise of the transistor has been fulfilled. Here is the transceiver you will want to own . . . whatever you have now, get ready to trade up. Its important features are far too numerous to list. Its specifications are superb. The TS-900 is unquestionably the best transceiver of its kind ever offered.

The price $795.00

PS-900 (AC Supply) $120.00, the DS-900 $140.00



TS-520

Kenwood's go every place . . . do everything transceiver

The new TS-520 is the transceiver you have wanted, but could not buy until now. It is a non-compromise, do everything, go everywhere 5 band transceiver for SSB or CW that performs equally well at home, in an automobile, airplane, boat or trailer. The TS-520 features built-in AC power supply, built-in 12 volt DC power supply, built-in VOX with adjustable gain delay and anti-VOX. The price $629.00

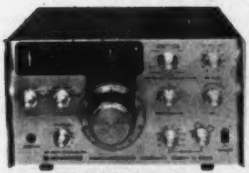
The "Twins" by Kenwood

The R-599A is the most complete receiver ever offered. It is solid state, superbly reliable, small and lightweight, covers the full amateur band . . . 10 thru 160 meters, CW, LSB, USB, AM, AM.N and FM.

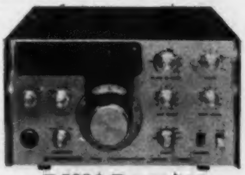
The price $459.00

The T-599A is mostly solid state . . . only 3 tubes, has built-in power supply, full metering (ALC, Ip. RF output & high voltage), CW-LSB-USB-AM operation.

The price $479.00



R-599A Receiver



T-599A Transmitter

See the Kenwood line at the following dealers: • **ALABAMA** / L & T Electronic Specialties, Birmingham • **ALASKA** / Service Electric Co., Inc., Ketchikan • **ARIZONA** / Ham Shack, Mesa • Orbit Electronics, Tucson • **CALIFORNIA** / Communications Headquarters, San Diego • Gary Radio, Inc., San Diego • Ham Radio Outlet, Burlingame • Henry Radio, Anaheim • Henry Radio, Los Angeles • Webster Radio, Fresno • **COLORADO** / Radio Communication Company, Arvada • **FLORIDA** / Amateur Electronic Supply, Orlando • Amateur Radio Center Inc., Miami • Amateur Wholesale Electronics, Miami • Grice Electronics Inc., Pensacola • Hollister Electronic Supply, Jacksonville • **GEORGIA** / Clayton Communications, College Park • **IDAHO** / United Electronics Wholesale, Twin Falls • **ILLINOIS** / Klaus Radio, Inc., Peoria • **INDIANA** / Graham Electronics, Indianapolis • Hoosier Electronics, Terre Haute • Radio Distributing Company, South Bend • **IOWA** / Hobby Industry, Council Bluffs • **KANSAS** / Associated Radio Communications, Overland Park • **MAINE** / Down East Ham Shack • **MARYLAND** / Electronic International Service Corp., Wheaton • Professional Electronics, Baltimore • **MICHIGAN** / Electronic Distributors, Muskegon • Radio supply & Engineering Company, Detroit • **MINNESOTA** / Electronic Center, Minneapolis • **MISSOURI** / Ham Radio Center, St. Louis • Henry Radio, Butler • **MONTANA** / Conley Radio Supply, Billings • **NEW MEXICO** / Gene Hansen Company, Corrales • **NEW YORK** / Adirondack Radio, Amsterdam • Harrison Radio Corp., Farmingdale, New York City, Spring Valley • Tom's Radio, Johnson City • **NORTH CAROLINA** / Freck Radio, Asheville • Vickers Electronics, Durham • **OHIO** / Amateur Electronic Supply, Cleveland • Communications World, Cleveland • Queen City Electronics, Cincinnati • Srepco Electronics, Dayton • **OKLAHOMA** / Derrick Electronics, Broken Arrow • Radio, Inc., Tulsa • **OREGON** / Portland Radio Supply, Portland • **PENNSYLVANIA** / Electronic Exchange, North Wales • JRS Distributors, York • Kass Electronics, Drexel Hill • **SOUTH CAROLINA** / Accutek, Inc., Greenville • **SOUTH DAKOTA** / Burghardt Amateur Center, Watertown • **TEXAS** / Douglas Electronics, Corpus Christi • Electronics Center, Inc., Dallas • Ed Juge Electronics, Inc., Fort Worth • Madison Electronics, Houston • **UTAH** / Manwill Supply Company, Salt Lake City • **WASHINGTON** / Amateur Radio Supply Company, Seattle • **WISCONSIN** / Amateur Electronic Supply, Milwaukee •

Prices subject to change without notice.

worked, does he build or buy, has he ever visited Indiana (or wherever I might be)?

One of the important things I like to hear from other ops is how my signal sounds. I have heard a few novices get into lengthy discussions about signal reports and maybe how one person's signals are not quite chirpy but that there is a definite frequency change during key down.

Some amateurs seem to be afraid to tell the other operator if they have a little chirp or click. There are some people on the air who either never work weak stations or they just can't bring themselves to give an honest 249 signal report.

Most novice ops have to depend on signal reports from other hams for any idea how their transmitter or antenna is performing. Sending an inflated signal report in hopes of avoiding embarrassment or insuring receipt of a much needed QSL card is a disservice to any operator.

If you feel like talking awhile you may have to ask some questions of the other guy before you get the conversation going. But if you do get a rag chew going remember to keep the transmissions short to make sure you are being copied.

There is very little reason for hit and run contacts on the novice bands. The ARRL suggests we refrain from talking about religion, politics or sex on the air. That leaves a pretty good selection of things we can and should be discussing.

Schley Cox WN9LHO

Guest Editorial

JERSEY SHORE AMATEUR RADIO SOCIETY

Ye olde editorial staff was sitting around with a bunch of hams at the recent ARRL convention. We had been up and down the three "large" rooms of exhibits, and had sat in on one forum and part of a second. About halfway through the second forum, we started getting internal signal reports that it was time to refresh and restoke. Finding a nearby oasis, we cuddled around a Tequila Daisy and then noted that we were surrounded by several other hams intent on the same purpose. After nodding a time or two to establish our mutual relationship in amateur radio, we gave a password which joined us all into a small congenial group, "Hi there, can I buy you a drink?" Several Tequila Daisies later, we were all well introduced and seemed to represent not only the W2 area, but also several W3's, W4's and one W6.

Discussions began with reaction to the convention. It must be reported that aside from two of the fellows who were involved in part of the convention activity as participants, the overall reaction was one of disappointment. "Oh, it's great to eyeball so many of your old contacts" but it would appear that the facilities were not particularly geared to what one might expect of a convention which was billed as being national in concept. Great expectations regarding what the major manufacturers were going to unveil during this gathering were dashed as one traveled through the exhibition rooms. Oh there were a few presentations, but the absence of companies such as Drake and Heath were apparent. One could purchase touch tone pads and bargain LEDs (shades of our local flea market). The fellow cutting callsign badges had a waiting line, even the opportunity to guess how many pieces of junk (including used cigar butts) were contained in a bottle for a prize seemed to draw a crowd seeking fulfillment of their original expectations. A stranger to the hobby could easily wonder at the limited amount of emphasis placed on other than 2 meter FM.

Another point which met with accumulated nods of our assembled group was that several of the forums and seminars did an excellent job in presenting programs geared towards specific interests. One of the W3's noted, however, that in his opinion, some of the interest areas were so esoteric that the average ham who enjoys amateur radio as an outside hobby might find himself as lost as a high school youngster sitting in on a graduate class. This thought was picked up by tbe W6 who advised that he had sat in with the W3, and although he had professional background in the field, he found the choice of interesting groups was rather limited. The ad hoc group agreed that more choice on the part of the general membership to suggest seminars and forums might have engendered specific areas to be presented which would have more realistically represented the broad spectrum and level of ham interests. The W6 suggested that it was the responsibility of the member to rise to the level of the presentation or he really couldn't consider being a "real" amateur. (The fact that he had ceased to spring for any more rounds was not lost upon the group, and so they gave this arrogance the sneer that it deserved.)

About this time, our group was graced with the presence of a rather fetching YL who soon introduced herself as a fellow ham from W4 land. Sharing from our beaker of Daisies, she also shared a personal view with us. It seems that although she has been in amateur radio for quite a few years and holds a respectable advanced license, her status in the fraternity is generally relegated to a subservient level of something classified as "XYL or YL." "Good grief" she exclaimed, "I can handle a key, mike or soldering iron as well as most other hams (the Tech's and Conditional's in the group seemed somewhat nervous). Why do the various groups seem to consider us as people who make sandwiches while ham activity takes place? Why do they always seem to think that they must advise that YL activities are available? In point of fact, why do they set up YL groups and nets which definitely create a difference in the minds of many as to the ability of female amateurs? An amateur is an amateur. No wonder so few XYL's take an active interest in what seems to be a male-oriented activity.

"We feel as if we are trespassing into the 'MEN'S ROOM!" (Noting the number of Daisies she had consumed in this short time, we can attest that she would fit right into many of the radio club meetings we know of.)

Well, it seemed time to return to the convention room and so we set on and said our 73's to the group. Our discussion had turned to what several of the members termed, "the attitude of apathy within the radio fraternity" and we felt that this was discussion for another day. We admit to thinking how sad their home clubs must seem if they were beset with this problem of membership apathy — and we bethought of how lucky we were in our own JSARS club. So we merely smiled and walked out — warmed by the thought of the upcoming annual club picnic.

The KaChunker WR2ABR

Book Review

WORKING 1600 METERS

W2IMB has a little book out on QRP use of the 160-190 kHz band. This is NOT a hamband, but one open (with some restrictions) to anyone who wants to experiment with it. The book discusses antennas, circuits, DX that has been worked, sked times, etc. Send $1.75 for the book to Ken Cornell, Box 721, Westfield NJ 07091.

50 MHz BAND

Bill Turner WA0ABI
Five Chestnut Court
St. Peters MO 63376

WB4OSN says August brought a number of openings but nothing very spectacular. Joe worked the Northeast, plus a few 8's, 9's and 0's and heard the TI2NA beacon a few times. The WB0ELN QSL finally arrived in Margate, Florida making 48 confirmed for Joe. . .congratulations are due! The final comment is a sad one, other KZ5's report that Don KZ500 has left the Canal Zone.

John WA2UON says he has been reading this column for some months and has recently gotten active on the band. John lives in Castleton-on-Hudson, New York and is interested in contacting a club in the Eastern New York area. Anyone with information is invited to contact John at 1216 Maple Hill Road. . .the ZIP is 12033.

Seven contacts in six new states isn't a bad evenings work. That is the record according to Nick WA4ZDP of Jacksonville, Florida (wife Diane is WA4ZDQ). Nick worked Vermont, Connecticut, Ohio and four other states during an opening July 25th. Stations were heard as high as 50.200 and as low as the bottom of the phone band. The equipment consists of an FT-101B, FTV650 transverter, five elements at 60 feet with a Spectronics DD-1 digital readout as frosting on the cake. Commenting on other local activity, Nick says "Big Al" WA4HLP worked VE, KP4 and 30 states in one month.

SMIRK has passed the 500 member mark and shows no sign of stopping there. It is very encouraging to note the amount of activity generated by a relatively new organization founded by a relatively small group. This group has promoted 50MHz operation to a greater extent than anything since the Sunspot peak of the late 50's. More power to them and others working along side to generate the interest and activity the band so sorely needs. I for one would very much like to see a close association between the major Six Meter organizations, SMIRK, S.P.E.S.M., and the SIX-SIX Club, Inc plus the numerous smaller groups in order to further increase activity, work for RFI legislation, persuade manufacturers to design and produce equipment, and represent the 50MHz fan in FCC matters.

As an example, would it not be worthwhile to petition the FCC to allow phone in the 50.0-50.1 band segment? I cannot recall having ever heard more than a half dozen stations on CW in this 100kHz, even during the widest of openings. What little CW there is normally finds its way into the phone segment (or should I say Technician segment). Obviously the lower the frequency the more common the openings and the longer they last. Why should the vast majority be denied for the benefit of the few? Incentive you say? NONSENSE! If the desire were to upgrade the quality of the operator the proper way to go about it would be to dangle something he wants. My proposal is this.

1. Open 50.0-50.01 to all classes, CW ONLY. The space available would then be in keeping with the number involved.

2. Open 50.01-50.1 to PHONE, General and above. There would then be valid reason for the thousands of Technician Class licensees to improve their lot by upgrading.

I frankly have reservations in proposing the above. I have never felt that the good of amateur radio was served by setting off "lower" class operators to themselves. I know of no other activity which segregates the master from the apprentice. The archer, the bowler, the ball player all play on the same field and learn from the more experienced. If we must be divided, let us do it in some reasonable manner. . . .WA0ABI

HAM HELP

This column is for those needing help in obtaining their amateur radio license.

If you need help, let 73 know — don't be bashful — the readers are solid gold and are anxious to help you. If you would like to help, let 73 know about that plus your area of expertise, if any, so we can list you for either general help or as a technical advisor.

The following need some help — can *you* spare some time? Clubs in particular take note.

Authur L. Avillo, 5848 Garden Avenue, Marysville CA 95401.

Alan Kline, 30 King Street, Lynn, Mass. (ph 617 595-0873).

Leonard E Booth, 3123 South 13th, Niles MI 49120. (ph 684-3578).

W. Kenneth Lidman, c/o Walter Lidman, 12 Irwin Place, Hazlet NY 07730. (ph 201 26405371).

W. J. Elperin WN0LDN, 936 Curran Avenue, Kirkwood MO 63122.

SOCIAL EVENTS

SAN DIEGO NOV 1–3

ARRL SW Division convention — Town and Country Hotel — talk in 34-94, 3900, 7250. $5.50 registration, $9.75 banquet. Write Box 82297, San Diego CA 92138 for info and pre-registration details.

MANILA NOV 8 & 9

South East Asian Net Convention. For info write DU1JO, P.O. Box 386 MCC, Makati, Philipines.

CANTON – NOV 22

Massillon ARC Annual Flea Market and Auction. Send card for map and details: Marc, Box 8711, Canton OH 44711.

DELAWARE QSO PARTY
NOV 30

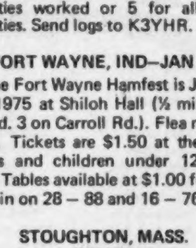
Starts 0001z Sat. Nov. 30 and runs for 24 hours. Good news for ops still needing Deleware on some band. Try 3560 7060 14060 28160 or 3975 7275 14325 21425 28650 or (Novices) 3710 7120 21120 28160. 5 pts per Deleware station, 3 for two counties worked or 5 for all three counties. Send logs to K3YHR.

FORT WAYNE, IND–JAN 19

The Fort Wayne Hamfest is January 19, 1975 at Shiloh Hall (½ mile west of Ind. 3 on Carroll Rd.). Flea market, food. Tickets are $1.50 at the door. XYLs and children under 12 years free. Tables available at $1.00 for 4 ft. Talk in on 28 — 88 and 16 — 76.

STOUGHTON, MASS.
NOV 10

HUGE AUCTION. The Minuteman Repeater Assn., a club with more than 300 members, will hold an auction with tons of good equipment on Sunday, Nov. 10, starting at 1PM, at the Stoughton High School. Bring your own goodies to be auctioned if you wish (club takes 10% of selling price). Snack bar, refreshments. For info call Maurice Finer K1GGP, Milton MA 617-698-7198.



REPEATER UPDATE
LISTENING
94 76 88 73 70 64 82. . .

Revision of Recently Published Repeater Atlas

NEW MEXICO

WR5ABH	Albuquerque	6.01-6.31
WA5VKY	Albuquerque	6.13-7.06
WR5ABV	Capitan	6.34-6.94
WR5ABU	Los Alamos	6.28-6.88
WR5ACE	San Antonio	6.16-6.76
WR5ACM	Mt. Taylor	6.34-6.94

NEW YORK

WR2ADM	Bellmore	6.25-6.85
WR2ABU	Boston	6.31-6.91
WR2ADR	Buffalo	6.13-6.73
WR2ACM	Dunkirk	6.25-6.85
WR2ABL	Elmira	6.10-6.70
WR2	Hunter	6.28-6.88
		444.55-449.55
		223.38-224.98
WR2ABD	Ithica	6.37-6.97
WR2ABW	Larchmont	CLOSED
WR2ADZ	Long Island	7.973-7.375
WR2ABA	Long Island	52.64-52.525
		7.81-7.21
WA2KSB	Long Island	6.10-6.70
WR2ACW	Long Island	6.145-6.743
W2OQI	Long Island	6.22-6.82
		6.58-6.82
WR2ACG	Long Island	7.085-7.685
WR2	Long Island	7.73-7.13
WR2ACH	New York City	6.28-6.88
WR2ACO	New York City	7.60-7.00
W2JUP	New York City	7.87-7.27
WR2ABK	New York City	7.915-7.315
WR2	New York City	444.55-449.55
WR2	New York City	223.26-224.86
		444.70-449.70
K2QGT	New York City	449.30-444.20
WR2AAA	Manhattan	442.05-447.05
		7.73-6.73
WR2ACD	Manhattan	6.40-7.00
		449.30-444.30
WR2	Norwich	6.07-6.67
WR2ACT	Olean	6.25-6.85
		6.34-6.94
WR2ADF	Oswego	6.25-6.85
WR2ADC	Pearl River	7.72-7.12
WA2UWQ	Rochester	6.28-6.88
WR2ADW	Rome	6.34-6.94
WR2ADN	Saratoga	6.40-7.00
		445.10-147.00
WR2ABV	Schenectady	6.46-7.06
WA2RJX	Syracuse	6.04-6.64
WR2ACL	Troy	6.34-6.94
WR2ADW	Utica-Rome	444.2-449.2
		6.34-6.94
WR2ACR	Watertown	6.10-6.70
WR2	Watertown	6.16-6.76
WR2ACN	Woodmere	6.04-6.64
WR2ABW	Yonkers	6.31-6.91

NORTH CAROLINA

WR4AEV	Asheville	6.16-6.76
		222.34-223.94
WR4AGF	Asheville	6.22-6.82
WR4	Asheville	6.31-6.91
WR4	Burlington	6.07-6.67
WR4AGC	Durham	6.22-6.82
WB4QFT	Durham	449.10-444.10
WR4ADT	High Point	6.40-7.00
		447.90-442.90
WR4AFV	High Point	6.19-6.79
WR4	Laurinburg	6.07-6.67
WR4ABX	Lexington	6.31-6.91
		222.30-223.90
		443.31-448.91
WR4	Manteo	6.34-6.94

NORTH DAKOTA

WR0ACJ	Bismark	6.34-6.94
WR0ADQ	Fargo	6.16-6.76

OHIO

WB8CXO	Akron		7.60-7.00
WR8ACI	Athens		6.34-6.94
UC	Canton		6.19-6.79
WR8	Central Ohio		6.46-6.06
WR8ACB	Cincinnati		6.115-6.70
WR8ACC	Cincinnati		7.90-7.30
WR8	Cincinnati		448.90-443.90
WR8ACP	Cleveland		53.15-52.79
WR8ABL	Cleveland		53.25-52.00
WB8APD	Cleveland		52.92-52.68
WA8CEW	Cleveland		52.96-52.72
WB8CRV	Cleveland		6.28-6.88
WB8CRP	Cleveland		6.22-6.82
WR8ABC	Cleveland		6.16-6.76
			6.355-6.76
			449.95-447.95
WA8BBN	Cleveland		6.25-6.85
W8WV	Cleveland		6.115-6.715
W8TQA	Columbus		52.76-52.525
WR8ABV	Columbus		6.16-6.76
WR8ABR	Columbus		6.31-6.91
WR8ACA	Columbus		7.81-7.21
WR8ABR	Columbus		6.37-6.97
WR8ACV	Dayton		6.04-6.64
WA8PIA	Dayton		443.75-448.75
UC	Freemont		6.31-6.91
WR8ABW	Galion		6.25-6.85
WR8ACU	Hudson		6.01-6.61
WR8ACM	Marietta		6.28-6.88
UC	McConnelsville		6.22-6.82
WR8	Millersburg		6.07-6.67
WR8ABS	Monroe		6.01-6.61
WR8ABX	Newark		6.28-6.88
WR8ABJ	Newcomerstown		6.13-6.73
			6.325-6.73
K8JHG	Ottawa	W1.8	6.28-6.88
			52.76-52.525
WR8ADC	Toledo		6.01-6.61
WR8ACT	Toledo		6.34-6.94
			6.19-6.79
WR8ABU	Vandalia		6.25-6.85
WR8ACZ	Vandalia		442.85-447.85
K8NPY	Willowick		53.70-53.46

OKLAHOMA

WR5ADO	Bartlesville	6.16-6.76
WR5	Elk City	6.16-6.76
WR5	Lawton	6.34-6.94
WR5	Norman	6.28-6.88
WR5ADE	Oklahoma City	6.34-6.94
WR5ADO	Ponca City	6.37-6.97
WR5	Still Water	6.13-6.73

OREGON

W7DBS	Eugene	T1.8	6.10-6.70
K7TBL	Eugene		6.16-6.76
W7OFY	Grants Pass		6.34-6.94
WR7ADC	Klamath Valley		6.01-6.61
WR7ABK	Medford		6.34-6.94
WR7ADO	Philomath		6.22-6.82
WA7CHL	Portland		6.10-6.70
			444.45-445.45
WR7ABE	Portland		444.17-449.17
			6.34-6.94
WR7ADI	Portland		6.40-7.00

PENNSYLVANIA

WR3ACM	Altoona	6.22-6.82
WR3AAA	Freedom	6.25-6.85
WR3AAB	Lehigh Valley	6.10-6.70
WR3ABR	Mt. Holly Springs	6.28-6.88
WR3ADB	Muncy	6.22-6.82
WR3ACE	New Holland	6.01-6.61
		223.34-224.94
		444.15-444.15
WA3BKO	Philadelphia	6.16-6.76
WR3ABE	Philadelphia	52.76-52.64
		448.80-443.80
WR3ABK	Philadelphia	6.37-6.97
WR3ACK	Reading	52.575-52.680
WR3ACU	Philadelphia	52.82-52.38
WR3	Philadelphia	7.63-7.03
WR3ABZ	Philadelphia	7.66-7.06
WR3ABX	Philadelphia	223.34-224.94
WR3ACI	Pine Grove	6.04-6.64

TEXAS

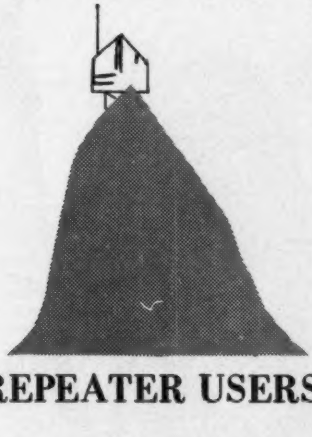
WB5AEI	Alice	444.10-449.10
W5CBT	Amarillo	6.34-6.94
		444.50-449.50
WR5ACO	Arlington	6.07-6.67
WR5	Arlington	7.75-7.15
WR5	Arlington	449.20-444.20
WA5YUO	Austin	449.10-444.10
WR5ACS	Beaumont	6.16-6.76
K5FPJ	Beeville	6.34-6.94
WR5ACI	Big Spring	6.22-6.82
WR5AEA	College Stn.	6.22-6.82
WR5ACD	Corpus Christi	6.34-6.94
WR5ACT	Corpus Christi	6.22-6.82
WA5YVK	Corpus Christi	6.28-6.88
WR5ABE	Dallas	6.13-6.73
WR5ABY	Dallas	6.28-6.88
WA5VKV	Dallas	449.00-444.00
K5IQP	Denton	6.28-6.88
WA5YTL	Denton	6.31-6.91
K5ZCO	Dallas	6.25-6.85
WA5YTM	Ft. Worth	6.34-6.94
		6.16-6.76
		449.10-444.10
WA5YUM	Ft. Worth	53.16-52.56
WA5YVC	Ft. Worth	448.90-443.90
WR5ACW	Georgetown	6.16-6.76
WR5ABJ	Houston	6.07-6.67
W5KAB	Houston	6.10-6.70
K5IHK	Houston	6.13-6.73
WA5YUB	Houston	6.16-6.76
WA5YUJ	Houston	6.19-6.79
W5PMQ	Houston	6.25-6.85
WA5LJO	Houston	6.31-6.91
WR5ABX	Houston	6.34-6.94
WR5ABS	Killeen	6.34-6.94
WR5ACZ	Lubbock	6.34-6.94
WR5	McAllen	6.61-6.76
W5TJD	Mineral Wells	6.04-6.64
K5FPI	Mt. Pleasant	6.34-6.94
W5LUP	Odessa	6.34-6.94
WR5ACA	Plainview	6.22-6.82
		6.22-6.94
WA5RUQ	San Angelo	449.20-444.20
WR5ADH	San Antonio	52.880-52.525
		6.22-6.82
		6.34-6.94
WR5ACL	San Antonio	6.01-6.61
		6.28-6.88
WR5ABR	San Antonio	6.16-6.76
WR5ADJ	San Antonio	449.10-444.10
WR5ACK	San Benito	6.34-6.94
WA5ZUP	Temple	6.13-6.73
WR5ACP	Temple	6.22-6.82
WR5ABF	Texarkana	6.22-6.82
WA5YTN	Victoria	6.34-6.94
WR5ABK	Waco	6.28-6.88
WR5ABO	Wichita Falls	6.34-6.94

MORE NEXT MONTH

Send any and all corrections, updates or new listings to 73 Magazine, Peterborough NH 03458.

REPEATER OWNERS

Don't Take Chances. SENTRY offers custom made crystals made exactly to your specifications. When it comes to crystals for your repeater, BUY THE BEST – SENTRY.



REPEATER USERS

If you want reliable access to the repeaters in your area, you want and need SENTRY CRYSTALS. SENTRY CRYSTALS are custom made for your rig. We don't stock a large quantity of crystals for a certain frequency and hope you can tweak them to frequency in your rig. We do offer FAST service on crystals made especially for you and your rig. If you want reliable, on-frequency operation, INSIST ON SENTRY.

SENTRY MANUFACTURING COMPANY
Crystal Park, Chickasha, Oklahoma 73018
PHONE: (405) 224-6780
TWX-910-830-6425

Amateur Radio

MCMLXXIV Monthly Ham

THE NEXT VOICE YOU HEAR WILL BE. . .A HOOLIGAN

MOSCOW –Strange things can be heard crackling over the Soviet air waves these days – not from the hated foreign broadcast but from such stations as Radio Demon, The Diamond, Dragon, Ninochka, Black Soul, Sea Devil and Tempest.

They are all illegally operated inside the Soviet Union – mostly by young radio enthusiasts – and the government is taking ever more serious measures to stamp them out. However, with all of the modern electronic means of tracking down the private shortwave and ultrashortwave broadcasts, the authorities have found that as soon as one is silenced another pops up.

But the fact that the term applied to these illegal operators is "radio hooligans" indicates an even more serious official displeasure over the political jokes criticizing the regime, the distribution of information offending the government and the Communist Party, and the playing of rock music, which is regarded by the authorities as "degenerate" and "decadent bourgeois culture."

The above was reprinted from the Los Angeles Times and brought to our attention by Dave WB6ZGF.

STUDY OF LDE PHENOMENON

A startling new interpretation of the rarely observed phenomenon of "Long Delayed Echoes" is being researched by a small group of engineers at EMI's SE Computer Peripherals plant in Feltham, Middlesex, England.

The effect was first investigated by radio pioneers in the 1920s.

Led by Tony Lawton, SE's technical manager, the group is setting up an experiment to test an hypothesis by Scottish researcher, Duncan Lunan.

Lawton and his team are conducting the investigation in their own time, but with EMI's full backing. Even if they disprove Lunan's theory, they hope to shed light on a phenomenon that has puzzled scientists for decades.

The first reports of LDEs was published in a letter to *Nature* on November 3, 1928 by the ionospheric expert, the late Prof. Carl Stormer of Oslo. He and engineer Jorgen Hals observed LDEs on transmissions made by Dr. van der Pol using the Phillips experimental transmitter PCJJ at Eindhoven in Holland. The frequency used was 9.55 MHz with 15 kW into a long wire aerial.

Morse letter "S" was repeated at intervals of 30 seconds, and received almost instantaneously by Stormer and Hals. Also noticed was the fairly common one-seventh second echo effect as the signals circled the globe, but other distinct echoes were heard with intervals varying between 3 and 15 seconds.

Two French workers, J.B. Galle and G. Talon observed LDEs in May 1929 using a 500 watt transmitter on a wavelength of 25 meters. A description of the very long sequence of echoes with delays between 1 and 30 seconds was published by Galle and "L'Onde Electrique" Vol. 9, 1930.

The key lies in the plotting of a simple graph for each echo sequence. The sequence of transmitted signals is plotted along the horizontal axis, while the delay of the echo (in seconds) is plotted on the vertical axis.

Stormer's sequence plotted in this way gives a pattern which Lunan points out bears a striking resemblance to the constellation Bootis.

The graphs for other sequences yield plots of many other recognizable stars and constellations.

Overall, the information, if such it is, decoded by Lunan is consistent with the hypothesis that LDEs are being returned by a space probe that arrived in the solar system from the star Bootis some 13,000 years ago to

Curt Powell, WB4WAA, makes an adjustment to the WR4ABP repeater located at 1300' on the WITN-TV tower at Grifton, N. C. The 146.16/76 FM repeater was first licensed in May 1972 as W4NBR and was constructed by F N C Repeater, Inc., an amateur club of 60 members residing throughout eastern North Carolina. The unit is radio controlled via 450 MHz from five control points. An elevator in the WITN-TV tower provides easy access for infrequent maintenance of the solid state repeater which now uses transmitter and receiver boards from a Standard 803 transceiver.

search for intelligent life, as manifested by radio transmissions.

Tony Lawton and his colleagues plan to put this to the test by beaming transmissions, probably using a high powered 144 MHz transmitter and a high gain aerial.

PEOPLE'S REPUBLIC OF CHINA

The People's Republic of China has acceded to the International Telecommunication Convention, 1965, but has made three statements including one to the effect that China makes reservations on the articles concerning the assignment and utilization of radio frequencies in the Radio Regulations. In other words there is still no regulatory backing for repeated requests for the removal of unwanted broadcast stations in the amateur exclusive band, 7 to 7.1 MHz.

The form of call signs to be issued by the Chinese administration to amateur stations is:

The letter B followed by a letter designating the geographical area followed by a single digit, and then followed by the letter A or A with one of two letters.

The letters designating the geographical areas are listed below:

F — Shensi, Honan
G — Nanking
H — Shanghai
I — Kiangsu, Chekiang, Anhwei
J — Hankow
K — Hupeh, Hunan, Kiangsi
L — Chungking, Szechwan, Sikang, Tibet
M — Yunnan, Kweichow
N — Kwangtung
O— Canton, Kwangsi, Fukien
P — Peiping, Tientsin
Q — Hopeh, Shantung, Shansi
R — Jeohl, Chahar, Sulyuan
S — Kansu, Ningsia, Chinghai
T — The nine northeastern Provinces
U — Sinkiang
V — Taiwan

FCC TASK FORCE HUNTS FOR HOME RADIO ABUSERS

No one knows when they'll hit town — it could be tomorrow. They move in under a cloak of secrecy and set themselves up in a lonely motel room or vacant office. They bring their equipment with them, the most sophisticated in electronics gear. Their cars are specially rigged with tracking devices. They have a van crammed with recorders, meters and detectors. The job takes about a week. They get what they need and move on to another town, another state.

These are not a band of super criminals setting up some slick caper. They come to town to track down the source of a common complaint from families throughout the nation — TV interference from home radio hobbyists. The FCC has recently reorganized and expanded a special task force division, setting up specialized 10-man enforcement teams assigned to "clean up" mounting abuses among operators of the popular "Citizens Band" radio rigs.

Reprinted from the Sunday Star-Ledger, Newark NJ.

WB1ETH

A Special Events Station, WB1ETH, was operated for the Bethlehem, NH Bicentennial the weekend of August 9, 10 and 11. Operators were Mike Blandin WA1RKH, Chris Hanson WA1SHO and Bob Daniels WA1ODG. The station transmitted approximately 35 radiograms, many being from passers-by to friends or relatives. We made approximately 90 contacts on 15, 20, 40 and 80 meters using a Ranger and an HW-101. Antennas were a 120′ dipole and a 22′ vertical. Those who contacted WB1ETH are requested to send a QSL and SASE to WA1RKH.

Mike Blandin WA1RKH
Box 25
Bethlehem NH 03574

RECIPROCAL LICENSING IN ISRAEL

Every radio amateur who presents a valid license from his own country can receive an Israeli license. At the time of government examinations, he will be questioned in those specific areas where it is felt that the technical level in his own country is lower than in Israel. Decisions regarding the technical levels will be based upon a comparison of the syllabus from the amateur's own country to the syllabus in Israel. An amateur who does not psss the examination, or decides not to sit for it, will automatically be issued an Israeli license that is one grade lower than his original license. Examinations are currently held in Israel twice a year during the school vacations of the holidays Passover and Rosh Hashana (the Jewish New Year).

In the case of the U.S., Canada, U.K. Austria and Costa Rica, special reciprocal licensing agreements exist. Amateurs from these countries may receive licenses during any period of their stay in Israel, and they are not required to sit for any examinations.

Amateurs who do not bring equipment can receive permission to operate every amateur station in Israel as second operators.

Further information, application forms for reciprocal licenses may be obtained from:

Ministry of Communications,
Engineering Services
Postbox 29107
Tel-Aviv, Israel

(from R. Kline 4X4NJ)

COUNCIL AVOIDS ROW WITH HAMS

Bell, California's City Council warded off a confrontation with irate ham and citizen band radio operators worrying that restrictive rules might be passed by the council (they were not considered).

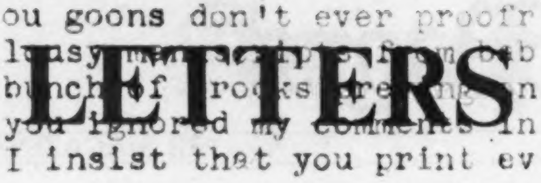
The meeting started off with an overflow crowd of some 125 persons jamming the council chambers, most of them amateur radio operators alarmed over reports that city officials might consider requiring special permits as a way of controlling transmitters interfering with television and radio reception and even telephone communications.

But a threatened protest never developed because city officials heard a report from City Administrator John Pitts that he had contacted owners of offending transmitters and they had cooperated fully by adjusting their sets or dismantling overpowered transmission equipment.

The council heeded the administrator's recommendation to drop the matter, and was immediately treated to the rare sight of a packed house cheering their actions.

Courtesy of Leonard R. Fox WA6SXK

LETTERS


ou goons don't ever proofr
lousy manuscripts from bab
bunch of crooks are
you ignored my comments in
I insist that you print ev

FM REBUTTAL

Re Al Chapman's (W6MEO) letter in the September issue of 73. The two meter FM "growing pains" here in the Southland are no different than most other large urban areas throughout the country. I can attest to this since I have had the opportunity to see the situation on both sides of the continent and a number of places in between; In most cases, one repeater, the one that combines the virtues of best area coverage with a minimal number of operating restrictions will become the congregating spot for the majority of operators. It will become the training ground for 9 out of every 10 newcomers to two meter FM. It was that way back in N.Y.C. on the old WA2SUR and is the same out here on a number of machines. No ham, whether he or she has been around amateur radio for more years than they wish to remember or is the newest of newcomers can be an "A-1 Op" the moment they enter the world of VHF-FM. Operating technique on a VHF repeater takes time and effort to learn in the same way one learns to be a champion DXer.

I must, however, take exception to Al's suggestion concerning types and duration of license. One cannot legislate a good operator into existance. A ham either wants the respect of his peers or he doesn't. It is not the class of license that one holds that makes him or her a good operator, but a sense of self respect. To carry this further, if a person has no respect for himself, then he will show little respect for others. The ham who will "step on you" on a two meter repeater is the same type of ham that will "step on you" while you are trying to get that "rare one" on 20 SSB. It's not the class of license that is at fault, but rather the personality traits of the operator.

Sure, many of our machines get plagued by "Kerrrchunker's," Jammers and poor operators. But a combination of peer pressure and the marvelous ability that we in amateur radio have to police ourselves usually works and those that are habitual offenders eventually change their ways or just "go away." If there is one shame to be found in this whole affair it is that in the process we sometimes also loose potentially fine members of the VHF-FM community due to the poor first impressions they may get. However, before you prejudge two meter FM and its associated repeaterized operation I suggest you think carefully about one of those "DX Pile-ups." In both cases you will find the "screwball" who has to spoil it for the rest of us. Remember, though, that we are hams because we love amateur radio and that there is a place in it for all of us regardless of what class we may hold. No band or mode is a utopia and each suffers in its own way. It is the obligation of all of us to build amateur radio from within if we are to survive.

Bill Pasternak WA2HVK/6
Associate Editor-Looking West

THANKS, STEVE WA1DFL

While reading the September 74 issue of 73, I noticed a letter from a ham whose call was very familiar. I refer to Steve Rich WA1DFL from Revere, Massachusetts.

I was a patient at Chelsea Naval Hospital in 1966 like a lot of other Viet Nam veterans. My dad brought my PC62B to the hospital for me to use to help pass the time. This is where I met Steve.

Steve became very friendly with us at the hospital. He began running phone patches and messages for the guys making them very happy. I'm sure I speak for all the guys when I say thanks Steve for making our stay enjoyable!

Ron Pariseau K1VSC

RECEIVER PROJECT WANTED

Your questionaire in the back of the just received 73 prompts me to write. Yes, there is definitely something I'd like to see in the way of a construction article.

Remember the old 6L6-807 ARRL rig? Everybody built one. . .at least it seemed that way back in 1946 when I first got my ticket. . .now nobody builds unless it's a Heathkit.

What I'd like to see in the way of a construction article would be a receiver. . .from 80 through 10 meters. . .using standard and readily available parts, straightforward circuitry and transistors where possible. I'd like to see this in the light of a re-birth of the home-built station where you can build something that is at least capable of keeping up with what is offered built up commercially, then possibly later, a matching transmitter. AM, CW and SSB, of course.

I am not capable of designing such a rig and I've written to QST every so often over the last quarter century and got nothing. Most responses are "design it yourself and submit it and we'll print it". Hmmm. . .nobody likes a smartass and so it goes, the good basic ham receiver you can build yourself is yet to be offered. Sure there is the specialized CW or SSB receiver either for a single band or one some engineer whipped up with exotic components or a squirrily circuit nobody could get to work. There must be someone in your vast circle of acquaintances in the ham world that can give us "The 73 Basic Receiver – you can build it yourself."

Oh, yes, how did you get the apple to move so fast and the bullet to stand still for the apple to pass through the bullet. . .at least that's the caption on the apple/bullet photo – OK so everybody makes a mistake.

Best to you and keep up the fine magazine.

. . .W4KFK

A GREAT AMPLIFIER

Wayne, I want to tell you about a great company that I read about in 73. I ordered a 2-meter 15 watt amplifier from VHF Engineering. It is well engineered and easy to build. I tested it and found it very stable and easy to tune up and broad band.

I drive the amp with a TR-22 measuring the power output with a Bird wattmeter from the front seat of my car – 20 watts out. Then I started my car engine – 26 watts out with a 5/8λ whip on the rear deck and 52 watts ERP.

Now that's a product that gives you your moneys worth.

Keep up the best magazine there is!

Robert A. Daffer, Jr. WB0FUR
3016 Bristol Court
Blue Springs MO 64015

COMTEC?

The communications technologies described by G. J. Hanneman (September, 1974) are exciting. The sad part is that we hams remain largely unaware of what lies around the next bend in the wire. Communications is what ham radio is all about. Yet we tend to think entirely in terms of ham radio (the far past) plus a little new stuff when the related ICs become available from the surplus dealers (the near past).

Hanneman has offered to write a couple of articles on the state of the art. By all means, let him bring us up to date. But don't stop there – 73 should keep us up to date with regular articles or even a column on communications technologies.

William W. Creitz K3TJC
Columbia MD

NOSTALGIA

And to think when I first subscribed you were selling lifetime subs for $25. Keep your head above water, we need you.

WA2MGA

WARNING

Fig. 4 of the 3000 volt power supply article in the July issue has a note that says to connect the neutral of the 220 volt (3 wire) line to the transformer if operating two 110 volt primaries in series.

This is very bad business, because if one of the line fuses blows you won't know it. A very slight drop in high voltage output results that is easily passed off as line voltage fluctuation, or is overlooked entirely. The primary with the fuse that didn't blow takes the entire load, and will overheat and burn out if operation is protracted or if the transformer is not greatly oversize.

The reason for this is that the transformer primary connected to the fuse that blew begins to act as a 110 volt secondary winding, excited from the other 110 volt primary that is still energized by the good fuse. If the upper fuse on the diagram blows, the fan will still operate and the bulb lights. If the bottom fuse blows, the relay still works.

One fuse blowing (normally only one will blow in case of momentary overload, or just old age sometimes) is an extreme case. In the meantime, differences in voltage between the two 110 volt sides, and they are never exactly the same, will cause differences in load sharing between the two primaries.

It is best not to make this connection. It is best to treat the two 110 volt windings in series the same as if they were one continuous 220 volt winding. Indeed, that's what they are, as far as the transformer operation is concerned. It's like having a 220 volt winding with a 110 volt tap, when the two primary ends (one start end, one finish end) are connected together, with the tap unused.

When the transformer is used on 110 volts, the two primaries are connected in parallel, and both share the load equally if the connections are made properly. They are treated like a single heavy winding and never individually fused. Similarly in series, the only way to ensure equal load sharing is to leave the "center-tap" unconnected to neutral, so that in effect one continuous 220 volt winding is active.

Ted Chernin KH6GI

TEETH GIVE FEEDBACK

It was one of those cases, my 90 day guarantee was in its last couple of weeks. One morning I was talking on my handheld 2m unit when, "Hey you have a sick radio there old man, you have feedback on your signal!" Well, the next day I went back to where I bought the unit to get it repaired. A day later it was back and there was that feedback again! I took it over to a friend's house and we talked over it with no feedback. I took a transmission — bang — there was the feedback. He placed his car keys near the mike and there was the feedback. Next we tried it with my partial dental plate out and no feedback. I put a 150pF silver mica from each side of the mike to ground and this cleared up the problem. Now I can wear my teeth and talk at the same time.

J.W. Greelak
Ontario CA 91762

MONO-REPRODUCER IMPROVEMENTS

Having built the Nono-Reproducer (K9VXZ Sept 74, 73 Magazine) I would like to pass along some improvements I made while experimenting with the unit.

I changed C1 to .01 from .05 to improve the high frequency response. The entire assembly was built in a Pamona box with BNC plug and jack already mounted (available from Gateway Electronics, St. Louis) for ease in connecting and disconnecting the unit, a feature valuable in demonstrations. All parts were mounted on a PC board to conserve space and improve the appearance of the unit. For line (1) in the original figure I used a piece of RG-17U coaxial cable, which I had in the junkbox, to improve the RF characteristics and to eliminate stray capacitance. This should, of course, be as short as practible.

I am now working on a Stereo Reproducer, utilizing the same design, while trying to retain the valuable foolproof features incorporated.

Michael R. Hanna K8UUO

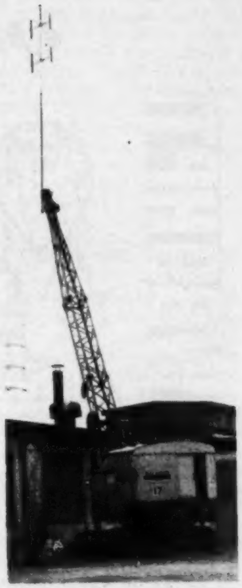
GREEN SUPPORTER

I've just heard the news and I'm horrified. Guess this is "old hat" to you and much could have happened since the original verdict was promulgated. . .I hope it has and I'm sure the "gang" is rallying round to give you support. Just what form this might take is difficult for me to imagine from this part of the world but I want you to know that I'm a Wayne Green supporter and if there is a call for some monetary aid, then I'll be a supporter again.

I realize too that you gave NZART some real help last year because of my request — just another aspect of your efforts in support of amateur radio in general. So — old friend — keep on keeping on. In spite of all, ever so many folks are very appreciative of your efforts over the years and I'm sure will expect you and "73" to continue to flourish in the future.

Good cheer to you and kindest to the family.

Jock White ZL2GX



ANTENNA

Enclosed is a photograph of, I think, a rather unique VHF antenna installation that I happened to come across recently. Possibly you will be able to use this photo in some future issue of 73 Magazine. Hope you can use it.

Pete Walton VE3FEZ

BACK ISSUES

I received the 36 issues of 73 which I ordered from the Book 'n Stuff portion of your magazine. I would like to say that it was one of the most enlightning deals I ever got. Just skimming through them brought back memories of circuits that were tried and, due to my ignorance, failed.

Most of them were from my "pre-FM" days and, having been almost exclusively FM for the last few years, I really got an education in the old tube circuits. Currently, there are plans afoot to put squelch in a converted AM rig (December '60 page 26) as the highly modified circuit I "stole" from a military receiver ain't so hot.

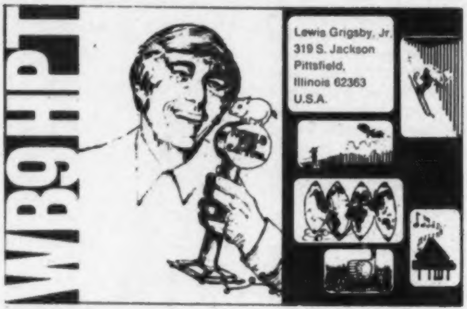
Again, many thanks for offering this fine selection. At 33¢ a copy, I kind of felt guilty about ripping you off. The other books I ordered were also quite interesting, especially the *VHF Projects for Amateur and Experimenter.*"

TNX es BCNU on VHF/UHF FM es CW.

Carl Hattan K0BZV/KL7

More LETTERS *on page 144.*

QSL CONTEST

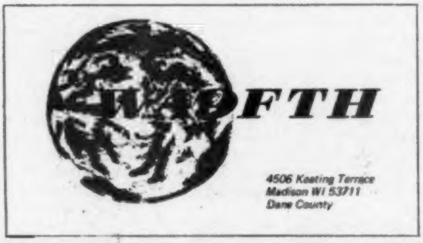


We have two winners this month. WB9HPT has not only designed a card which really stands out on a wall but by including illustrations of his other interests,he lets his contacts know more about himself. We have included the note which our co-winner, WA9FTH, sent along with his card. He receives a free one year sub as well as WB9HPT, proving that it pays to blow your own horn. If you think your QSL is something special, send it to 73, QSL Contest, Peterborough, NH 03458. You could win a one year subscription.

WINNING CARD

Enclosed you will find the winning entry for your QSL design contest. I am sure you will notice that this card design is striking and beautiful. I am almost ashamed to turn this beautiful card into your contest as it is so obviously superior to any other card in the world.

. . . WA9FTH

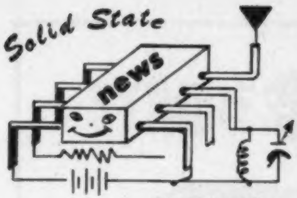


Mfr., Model, Ser. No.	Owner	Issue
Clegg 27B No. 72013-1068	W3BXL	7/73
STD. 826 MA No. 208078	WB2DEW	7/73
Drake ML-2 No 10582	W3MSN	8/73
Sonar FR-2528 No. 21-4250	Doherty	12/73
STD SRC-851-SH No. 9725		
STD SRC-707C No. 2833		
TPL PA-6-IDE No. 1092		
RP MEA-22 No. 212		
Two Larsen Antennas		
Swan 270 No. M-252616	W4NTB	12/73
STD SRC-146A No. 208070	W7DKB	12/73
Marker Luxury No 2296	W7BVP/6	2/74
Regency HR-2A 2m FM No. 04-05632	WB8NSU	3/74
Collins Model KWM-2 No. 13551	W9JS	3/74
Regency HR-2A No. 04-0787	WA3TVI	4/74
Kenwood TS-520 No. 840092	W7JFR	5/74
CW-520/511S filter		
Inoue EC-20 No 1161	W1PVF	7/74
1-RF Communications RF-403-2 VHF-FM XCUR No. 1277	K3YHR	7/74
Sonar 3601 No 1416	K1UXD	7/74
SBE Model SB-144 No. 46316 $25 reward $25 for information for arrest and conviction of thief.	K4KVF/5	7/74

The Hamburglar

STRIKES AGAIN!

Mfr., Model, Ser. No.	Owner	Issue
Clegg 27B No. 27103-2891	WA1ECF	7/74
Clegg 27B No. 27104-3498	W9VHD	11/74
Drake TR3 No. 12746A	W9VHD	11/74
Collins 30L1 No. 29625	W9VHD	11/74
Drake TR22 No. 620272	K3NCL	11/74
VHF Eng. 1501 amp	K3NCL	11/74
Std. 826M No. 203085	WA9VNW	11/74
Motorola Motran VHF Trans Serial No. DG153W	Contact 73	11/74
SBE SB-144 2m FM Trans Serial No. 720087	WA3IID	11/74
Varitronics HT-2, 146.97MHz Serial No. 640256	K3ZPH	11/74
Unimetrics Ultracom-25 Serial No. 090561	VE7AZG	11/74



Waller Scott K8DIZ
7318 Hollywood Drive
West Chester OH 45069

Thanks to the response of several of you readers, I have been selected to provide you with a monthly update on the world of solid state electronics. While I may have my ideas as to what types of circuits and devices you are interested in hearing about, I would greatly appreciate a short note, or even a QSL card, listing your solid state and experimenting interests. With your help we can make the best use of this space each month.

A growing number of hams are becoming interested in tone control circuits: repeater access control, Touch Tone signaling for auto-patch systems, tone keyed squelch, and remote control of whatever needs to be controlled.

Microsystems International has developed a series of telecommunication products using monolithic linear and digital ICs together with Tantalum thin and thick film technologies. Of particular interest is the MH8900 series of tone generators. This unit requires double pole Touch-Tone type switches in its keying circuit. It generates the standard tone dialing frequencies of 697, 770, 852, 941 Hz (low group) and 1209, 1336, 1477, 1633 Hz (high group). Supply voltage can be between 4.5 and 35 VDC. Current requirements are from 7 to 12mA depending on supply voltage. Typical rise time to a specified output frequency even when Vcc is switched — 5ms max. The tone generator is constructed in hybrid form using silicon ICs and the Tantalum thin-film process developed by Micro-systems. The circuit comprises unique, dual, high gain amplifiers with a bias and clipping network, coupled to modified parallel T filters. All capacitors and all but four resistors are fabricated using Tantalum thin-film resulting in a high degree of frequency stability and close tolerance. The resistors in each IC are precisely adjusted, with the circuit operating, by burning away resistance material with a laser! Worst case frequency drift of this IC is less than 1.5% when considering the effects of the temperature coefficients of the passive components, amplifier pulling, long term drift for the full lifetime (greater than 15 years), and varying supply voltages.

The MH8913J is being offered for sale by KA Electronics Sales (1220 Majesty Drive, Dallas TX 75247), including data and application sheets for $18.00 (see Sept. 73, pg. 153). Further info on this series of ICs can be obtained from Microsystems International Ltd., Marketing Mgr. — Telecom Products, Box 3529 Sta. C, Ottawa, Canada K1Y 4J1.

Other manufacturers are interested in the telecommunication market. Motorola will soon have available a CMOS version of a Touch Tone generator. The low power requirement should make this a winner. A CMOS Touch Tone receiver should be available in the not too distant future. More on these as info becomes available.

In those areas where Touch Tone service is not yet available on the land line circuits, some additional circuitry is necessary to interface your tone signals with the phone line for remote control or auto patch use. General Instruments has introduced a telephone dialer circuit which could perform the dialing into a pulsed dialing phone system. The AY-5-9100 is primarily intended for providing a way to use a push-button phone with a dial pulse only system. In a radio system a Touch Tone receiver could take the place of the push-button dial or keyboard. The transmission path would be something like this: FM transmitter modulated with tones — FM receiver demodulates tones — tones fed to a Touch Tone decoder — decoder drives AY-5-9100—AY-5-9100 drives transistor and dialing relay. The Touch Tone decoder could be constructed of seven 567 PLL tone decoders and some logic gates.

The AY-5-9100 contains four storage registers to store the dialed number in BCD format either in total or partially depending upon the difference between the dial in and dial out speeds. Pulse repetition rate, interdigital pause, and mark-space ratio are all programmable. Outputs are provided for line pulsing and muting. An input inhibit is provided to allow storage of one number of up to 20 digits. This allows the original dialed number to be redialed just by providing one command signal rather than repeating the dialing procedure. The IC operates from -15VDC and only requires 2 milliwatts of power. This is a PMOS IC available in an 18 pin DIP. It is available in single quantities for $20.00 from General Instruments Corporation, Microelectronics Div., 600 W. John Street, Hicksville, New York 11802. This is quite a sophisticated IC!

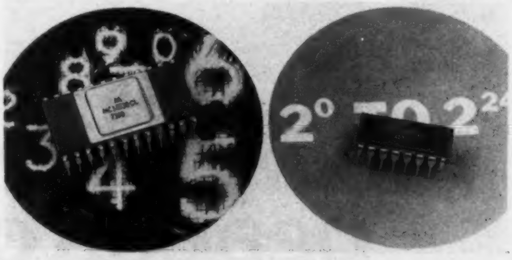
TIMERS AND COUNTERS

A flexible 24-stage ripple binary counter, and a real time 5-decade counter have been introduced by Motorola. Capable of counting from 1 to 2^{24}, the MC14536CP PROGRAMMABLE TIMER consists of 24 counters with the last 16 stages selectable by a four-bit select code. Real time event counting can be accomplished with the MC 14534CL FIVE DECADE COUNTER in continually update multiplexed displays.

By varying the input clock frequency of the MC14536CP Timer a wide variety of timing intervals can be achieved. Using a four-bit binary select code the output intervals can also be adjusted to meet the timing needs of many applications. An on-chip monostable circuit incorporating a pulse type output has been included. By selecting the appropriate output along with the correct input clock frequency, a variety of timing intervals can be achieved. Clock inhibit and set/reset input are also provided. The first 8 flip flops may be bypassed if desired. The maximum clock frequency for this CMOS is 3MHz at 10 volts, and the counter advances on the negative going edge of the clock pulse.

The MC 14534CL is a CMOS circuit composed of five decade ripple counters that have their respective outputs time multiplexed using an internal scanner. Outputs of each counter are selected by the scanner and appear on four BCD pins. The selected decade is indicated by a logic

Continued on page 139



Motorola MC14534 & MC14536

THE ultimate IN

Here it is, the FMer's dream, a fully synthesized transceiver that'll cover the entire two meter band, PLUS a built-in scanning receiver that'll locate any repeater frequency in your area that's in use. . .

$1495.00

- Frequency stability of 0.0005%
- Built-in tone burst and PL encoders and decoders
- Built-in touch tone pad
- Full LED Digital readout
- Built-in S Meter also serves as VSWR bridge, power output meter, battery indicator, deviation indicator and discriminator meter
- Audio output 4 watts @ 10% THD
- Speaker built-in to left side of cabinet for maximum mobile reception
- Headphone jack for noise-free mobile operation
- Independent selectable priority channel
- Built-in Auto CQ
- Temperature range from −20° to 170° Fahrenheit
- Size: 4" H x 8" W x 10" D Weight: 10 pounds
- One million channels (1000 Rec. x 1000 Trans.)
- Operates on FM, AM or Modulated CW
- Built-in DC and AC power supplies
- Frequency range of 143.5 to 148.5 MHz in 5 kHz increments
- Autoscan in 5 kHz steps across entire band, with adjustable speed and frequency limits
- Synthesizer flexibility that offers choice of 600 kHz up or down, 1 MHz up or down, simplex, frequency split, or any nonstandard split (programmable) all from a single function switch
- Receiver sensitivity of 0.35 mV for 12 dB SINAD on FM
- Dual power output of 20 watts or 5 watts across entire band
- Adjacent channel rejection (30 kHz) 100 dB minimum
- Image spurious and intermodulation (EIA) 80 dB minimum
- 10 pole, 13 kHz crystal filter

hear everything?

140–175 MHz
SYNTHESIZED RECEIVER

1 6 2.5 5
EBC-7000

Now monitor every channel – all 7000 of them – all synthesized – equal to $14,000 worth of crystals. That's right, you monitor every channel from 140 to 175 MHz. Keep track of police, fire, ham and marine frequencies. Easy-to-read thumbwheel switches set exact frequency down to 10 kHz. For split frequency or off channel there is a variable + or – 5 kHz fine tuning control. Tunable front end automatically changes as frequency is varied, assuring phenomenal .5 microvolt sensitivity. Works on 12 VDC or 117 VAC, both cords supplied.

$399.00

emergency beacon corp.

SYNTHESIZED FM TRANSCEIVERS

EBC 144 JR

HEY! This is like two transceivers in one! Fully synthesized covering 143.5 to 148.5 MHz in 5 kHz increments. Standard 600 kHz offsets up or down automatically. Reverse simplex and frequency split allow totally independent receive and xmit frequencies, and a priority channel guard that switches you back to it as soon as a signal is detected.

$599.00

- Sensitivity — .35μV for 12 dB sinad, .30μV for 20 dB quieting
- 20 watts output
- Intermodulation, spurious and image 60 dB minimum
- 10 pole xtal filter
- Frequency stability .001%
- S-meter speaker built in
- Independent selectable priority channel

Priority channel is functional but with the added plus of digital read-out of frequency. All the offset functions operate; thus, if the channel is a repeater with standard offsets, key the mike to lock onto that channel (with proper xmitter offset). Of course, any channel can be "locked out" of scan sequence. Those bright yellow LED digital readouts make night mobile operations a dream.

$199.00

- Scans any 6 channels
- Indicates offsets
- No xtals to buy
- Locks on xmitting channel
- Easily added to EBC 144 Jr.
- Room for options, i.e. tone burst, touch-tone pad, PL encoding
- Easy reprogramming of channels
- Individual channel lockout

Emergency Beacon Corp.
15-A3 River Street
New Rochelle, N. Y. 10801

Please send me:

☐ EBC-144 $1495.00 ($150.00 dep)
☐ EBC-144 Jr. $ 599.00 ($ 60.00 dep)
☐ EBC-145SA $199.00 ($20.00 dep)
☐ EBC-7000 $399.00 ($40.00 dep)

10% deposit will insure early delivery and guarantee price.

☐ Payment Enclosed
☐ Send further info.
☐ BankAmericard No.
☐ Master Charge No.
(Include four digit No. above name.)
Expires

Name____________________
St. Address____________________
City________________ State________ Zip________

Charles Lingo WA4RSX
2814 S.W. 5th Street
Miami FL 33135

DIPOLE ANTENNA TUNING

Much of what has been written about antennas, includes something about tuning. Relative to the dipole antenna, the procedure is to add or subtract from the lengths of the legs. This is what I am writing about, except that presently I can stand on the ground and change the lengths of the legs of the dipole by merely pulling or pushing the transmission line. The drawings are almost completely explanatory. They describe the additions I made to my 40m Inverted "V" Antenna.

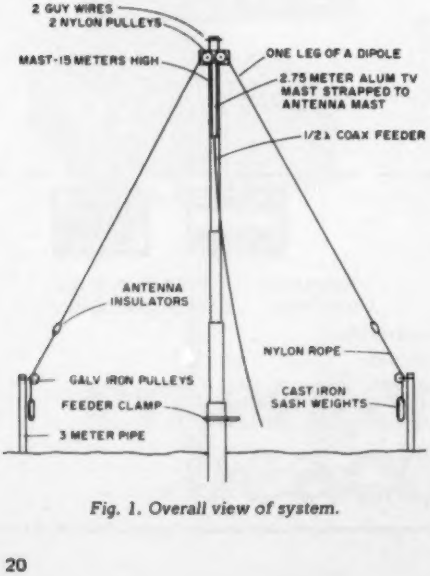

2 GUY WIRES
2 NYLON PULLEYS
MAST-15 METERS HIGH
ONE LEG OF A DIPOLE
2.75 METER ALUM TV MAST STRAPPED TO ANTENNA MAST
1/2 λ COAX FEEDER
ANTENNA INSULATORS
NYLON ROPE
GALV IRON PULLEYS
CAST IRON SASH WEIGHTS
FEEDER CLAMP
3 METER PIPE

Fig. 1. Overall view of system.

If you study the drawings a moment, you will see portions of the two legs of the antenna pulled into an aluminum pipe, which acts as a shield against pickup and radiation of radio frequency energy. The pipe is grounded of course, and each leg of the antenna is insulated for at least 3 meters beginning at the center of the dipole. I made my antenna from an old length of coax cable. The braid is stripped from the center conductor and insulation in one piece, and is

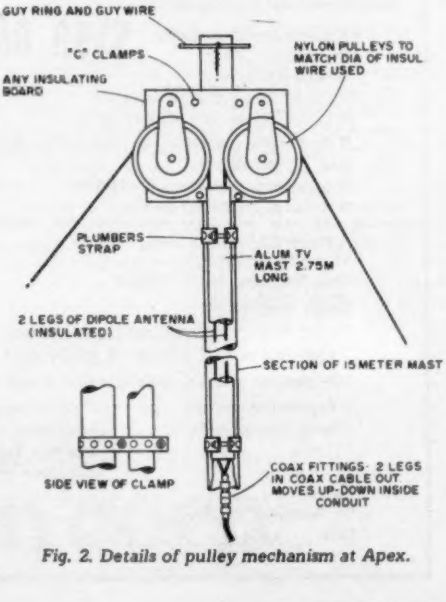

GUY RING AND GUY WIRE
"C" CLAMPS
NYLON PULLEYS TO MATCH DIA OF INSUL WIRE USED
ANY INSULATING BOARD
PLUMBERS STRAP
ALUM TV MAST 2.75M LONG
2 LEGS OF DIPOLE ANTENNA (INSULATED)
SECTION OF 15 METER MAST
SIDE VIEW OF CLAMP
COAX FITTINGS- 2 LEGS IN COAX CABLE OUT MOVES UP-DOWN INSIDE CONDUIT

Fig. 2. Details of pulley mechanism at Apex.

taped to prevent contact with the pipe shield or any other metal part. The center conductor with its nylon cover is ready to be used.

The two wires, at one time antenna and at another time transmission line in a pipe, raised a question in my mind. What would happen to the impedance and SWR? Could a low SWR be obtained? There was always a chance that a combination of lengths, change in position, etc., might compensate for the variable and unknown impedance, so I made alterations to my antenna and gave it a trial run. SWR's between 1:1 and 1:2 were easy, and quickly secured.

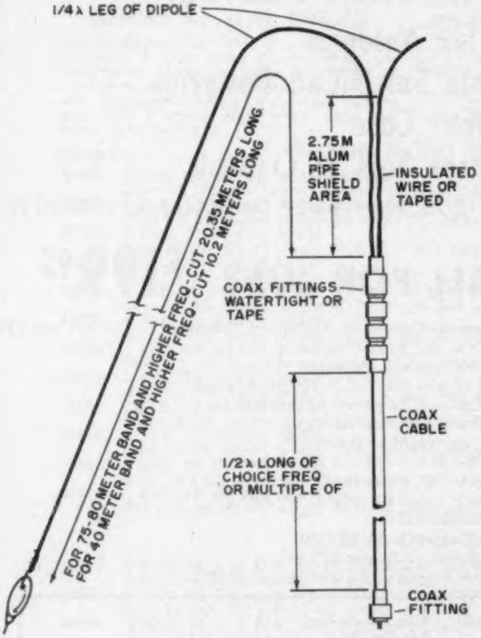

1/4λ LEG OF DIPOLE
2.75M ALUM PIPE SHIELD AREA
INSULATED WIRE OR TAPED
FOR 75-80METER BAND AND HIGHER FREQ-CUT 20.35 METERS LONG
FOR 40 METER BAND AND HIGHER FREQ-CUT 10.2 METERS LONG
COAX FITTINGS WATERTIGHT OR TAPE
COAX CABLE
1/2λ LONG OF CHOICE FREQ OR MULTIPLE OF
COAX FITTING

Fig. 3. A look at the actual antenna minus the supports.

Above the 80 and/or the 40 meter band the antennas act as harmonic antennas, for all higher frequencies, at least to the limit of the pipe shield length. Very little change in length of the legs is necessary to tune to the exact wavelength desired. It is recommended that the transmission line be calibrated for the most used frequencies so one can shift from one to the other without any trouble.

. . .WA4RSX

DATA SIGNAL

the latest in station accessories

AUDIO AUTOMATIC GAIN CONTROL AMPLIFIER

Is your tone decoder having problems due to input signal variations? If so, eliminate these and other problems caused by weak, strong or varying input signals. The AAGC-1 will take signal levels between 50 mV to 5 Volts and feed a clean rock stable signal to any decoder for perfect operation. Give your decoder a chance to decode properly with our AAGC-1 amplifier.

Shipping Weight 3 oz. $14.95 kit
$19.95 wired

DELUXE RECEIVER PREAMPS

Specially made for both OLD and NEW receivers. The smallest and most powerful single and dual stage preamps available. Bring in the weakest signals with a Data Preamp. Now with improved FET's for greater performance.

BAND	STAGES	GAIN	NOISE FIGURE	KIT PRICE	WIRED PRICE
10 meter	Single	25 dB	2 dB	$15.50	$18.50
6 meter	Single	25 dB	2 dB	$15.50	$18.50
2 meter	Single	20 dB	2.5 dB	$15.50	$18.50
2 meter	Double	40 dB	2.5 dB	$30.50	$36.50
220 MHz	Single	17 dB	2.5 dB	$15.50	$18.50
220 MHz	Double	35 dB	2.5 dB	$30.50	$36.50

CRICKET 1 ELECTRONIC KEYER

A popularly-priced IC keyer with more features for your dollar. Cricket I is small in size and designed for the beginner as well as the most advanced operator. It provides fatigue-free sending and its clean, crisp CW allows for easy copying at all speeds. Turned on its side, the Cricket can be used as a straight key for manual keying. Right or left hand operation. AC/DC.

Shipping Weight 3 lbs. $49.95

OTHER EXCITING PRODUCTS INCLUDE
TOUCHTONE TO ROTARY CONVERTER
TOUCHTONE TO TOUCHTONE CONVERTER
TOUCHTONE PADS
AUTOMATIC DIALER
ANTI-FALSING TOUCHTONE DECODER
AGC AMPLIFIER

Write today for complete details

Data Signal, Inc.
Successor to Data Engineering, Inc.
2212 Palmyra Road
Albany, Ga. 31701
912-435-1764

Wilson Electronics

DIRECT

SPECIAL XMAS SALE

WILSON 1402SM HAND HELD 2.3 WATT FM TRANSCEIVER

*Rubber Flex Antenna

*Complete Set NiCad Batteries

*Leather Case

*Three Sets of Crystals

16/76, 34/94, 94/94, Other Available at $8.00 Pr.

ALL FOR JUST $199.95

- 6 Channel Operation, Individual Trimmers On All TX and TR Xtals. All Xtals Plug In.
- S Meter Battery Indicator.
- 10.7 IF and 455 KC IF Ceramic Filter.
- .3 Microvolt Sensitivity For 20dB QT.
- 2.3 Watts Minimum Output.
- Microswitch Mike Button.
- Size 8-7/8 x 1-7/8 x 2-7/8 Inches.
- Weight 1 lb. 4 counces, Less Battery.
- Current Drain Rx 14MA TX 380 MA.

ACCESSORIES:

SMI Speaker Mike $24.00
BCI Battery Charger $29.95
1410A Amplifier Mobile Mount $99.00

To: Wilson Electronics
P.O. Box 794
Henderson, Nevada 89015
(702) 451-5791

Ship me 1402 SM Special Summer Package
Plus ☐ SM1 ☐ 1410A ☐ BC1

Enclosed is $ ________________ ☐ Check ☐ Money Order
☐ Master Charge ☐ Bank Americard
________________ M/C Interbank # ________________
Card Expiration Date ________________
Extra Xtals ____________ ____________ ____________

Name ________________

Address ________________

City and State ________________ Zip ________

All orders will be shipped Air Mail within 24 hours after receipt of order (excluding weekends). Enclose additional $3.00 for prepaid Air Mail shipping. Nevada residents add sales tax.
Sale ends October 31, 1974

WILSON ELECTRONICS

W7GVA designed MONO & DUO BAND BEAMS

QUALITY MONO & DUO BAND BEAMS AT LOW PRICES

Wilson Electronics offer a complete line of Mono & Duo Band Beams. With our purchasing power on large quantities of aluminum and low overhead, we can give you a rugged heavy duty top quality beam for a much lower price than any other manufacturer.

NEW IMPROVED WIDE SPACED 40, 20, 15 & 10 METER BEAMS

All W7GVA beam elements are constructed of the finest aluminum available, 6063T832 and 6061-T6 both top quality alloys.

All Wilson Electronics beams have a 3" O.D. boom made of top grade aluminum 6063-T6.

All our beams come complete with adjustable reactance tuned gamma match network which can handle 4 KW plus on CW and SSB.

WILSON MONO BAND BEAMS

Model No.	
M340	**3 ELE. 40 METER BEAM (full size)** Gain 8.5 DB gain. Boom length 38.5 ft. 3" OD .200 wall to .065.
M240	**2 ELE. 40 METER BEAM (full size)** Gain 5.5 DB. Boom length 16 ft. 3" OD .065 wall.
M720	**7 ELE. 20 METER BEAM** Gain 14 DB. Boom length 58.5 ft. 3" OD .200 wall to .065 wall.
M620	**6 ELE. 20 METER BEAM** Gain 13 DB. Boom length 50 ft. 3" OD .200 wall to .065 wall.
M520	**5 ELE. 20 METER BEAM** Gain 12 DB. Boom length 40 ft. 3" OD .065 wall.
M420	**4 ELE. 20 METER BEAM** Gain 10 DB. Boom length 30 ft. 3" OD .065 wall.
M320	**3 ELE. 20 METER BEAM** Gain 8.5 DB. Boom length 20 ft. 3" OD .050 wall.
M715	**7 ELE. 15 METER BEAM** Gain 14 DB. Boom length 40 ft. 3" OD .065 wall.
M615	**6 ELE. 15 METER BEAM** Gain 13 DB. Boom length 32 ft. 3" OD .065 wall.
M415	**4 ELE. 15 METER BEAM** Gain 10 DB. Boom length 20 ft. 3" OD .065 wall.
M810	**8 ELE. 10 METER BEAM** Gain 14.5 DB. Boom length 40 ft. 3" .065 wall.
M510	**5 ELE. 10 METER BEAM** Gain 12 DB. Boom length 20 ft. 3" .065 wall.

WILSON DUO BAND BEAMS

DB62	**6 ELE. 20 & 2 ELE. 40 INTERLACED BEAM** Gain 13 DB—20 5.5 DB 40. Boom length 50 ft. 3" OD .200 wall to .065 wall.
DB52	**5 ELE. 20 & 2 ELE. 40 INTERLACED BEAM** Gain 13 DB—20 5.5 DB 40. Boom length 40 ft. 3" OD .200 wall to .065 wall.
DB54	**5 ELE. 20 & 4 ELE. 15 INTERLACED BEAM** Gain 12 DB—20 10 DB—15. Boom length 40 ft. 3" OD .065 wall.
DB43	**4 ELE. 20 & 3 ELE. 15 INTERLACED BEAM** Gain 10 DB—20 8.5 DB—15. Boom length 30 ft. 3" OD .065 wall.
DB32	**3 ELE. 20 & 2 ELE. 15 INTERLACED BEAM** Gain 8.5 DB—20 6 DB—15. Boom length 20 ft. 3" OD .050 wall.
DB76	**7 ELE. 15 & 6 ELE. 10 INTERLACED BEAM** Gain 14 DB—15 13 DB—10. Boom length 40 ft. 3" OD .065 wall.
DB65	**6 ELE. 15 & 5 ELE. 10 INTERLACED BEAM** Gain 13 DB—15 12 DB—10. Boom length 32 ft. 3" OD .065 wall.
DB44	**4 ELE. 15 & 3 ELE. 10 INTERLACED BEAM** Gain 10 DB—15 8.5 DB—10. Boom length 20 ft. 3" .065 wall.

If not available from your dealer write direct to factory for catalog or information and fast service. All prices F.O.B. factory. Wilson beams are available at the following dealers:

HENRY RADIO STORES	LOS ANGELES, CALIFORNIA
AMATEUR ELECTRONIC SUPPLY	MILWAUKEE, WISCONSIN
AMRAD	OAKLAND, CALIFORNIA
HAM RADIO OUTLET	BURLINGAME, CALIFORNIA
HARRISON RADIO	LONG ISLAND, NEW YORK

WILSON ELECTRONICS

Box 794, Henderson NV 89015 (702) 451-5791/6650

NOW! BUY DIRECT

WHAT DOES THIS MEAN?

It means that GENAVE'S outstanding line of Amateur radios is now available to you at new, inflation-beating prices. A glance at the new prices confirms that the dealer's discount has been entirely eliminated, to your benefit. The same fine radios that you've seen in his shop may now be ordered on a Factory-Direct basis. **You** pocket the savings. Warranty policies remain the same: if your new GTX fails within three months of purchase, send it back. We'll fix it or replace it, **fast.**

Order TODAY—Orders will be processed as they are received!

Standard crystal frequencies in stock @ $3.75 each:

1¼ Meter		**2 Meter**		**6 Meter**	
TX	**RX**	**TX**	**RX**	**TX**	**RX**
222.30	223.50	146.01	146.34	52.25	52.38
222.34	223.90	146.10	146.52	52.525	52.525
222.38	223.94	146.12	146.61	52.70	52.60
223.14	223.98	146.16	146.70	52.76	52.64
223.26	224.74	146.19	146.72	52.82	52.68
223.30	224.86	146.22	146.76	52.88	52.72
223.34	224.90	146.25	146.79	52.92	52.79
223.50	224.94	146.28	146.82	52.96	52.80
		146.34	146.85	53.15	53.05
		146.52	146.88	53.25	53.08
		146.94	146.94	53.68	53.16

Contact factory for prices on other crystal frequencies.

Made In U.S.A.

Genave®

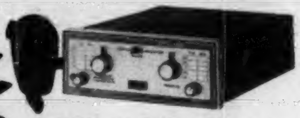
USE THIS HANDY ORDER FORM
TO HELP YOURSELF
TO GIANT SAVINGS!

General Aviation Electronics, Inc., 4141 Kingman Drive, Indianapolis, Indiana 46226—Area 317-546-1111

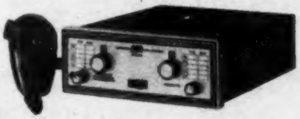
for GIANT SAVINGS!

GTX-600 6-Meter FM
100 channels, 35 watts
WAS $309.95
NOW
$219.95
(Incl. 52.525 MHz)

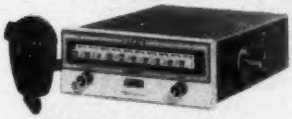
**Look at These
UNBEATABLE
PRICES!**



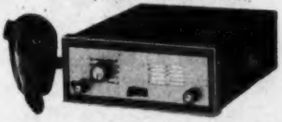
GTX-100 1¼-Meter FM
100 channels, 12 watts
WAS $309.95
NOW
$219.95
(Incl. 223.5 MHz)



GTX-200 2-Meter FM
100 channels, 30 watts
WAS $299.95
NOW
$199.95
(Incl. 146.94 MHz)



GTX-2 2-Meter FM
10 channels, 30 watts
WAS $299.95
NOW
$189.95
(Incl. 146.94 MHz)



GTX-10 2-Meter FM
10 channels, 10 watts
WAS $239.95
NOW
$169.95
(Incl. 146.94 MHz)

CLIP OUT AND ORDER NOW!

GENAVE, 4141 Kingman Dr., Indianapolis, IN 46226 73

HEY, GENAVE! Thanks for the nice prices! Please send me:

☐ **GTX-600** @ $219.95 $______
☐ **GTX-200** @ $199.95 $______
☐ **GTX-100** @ $219.95 $______
☐ **GTX-2** @ $189.95 $______
☐ **GTX-10** @ $169.95 $______
☐ **Lambda/30 2-M Base Antenna** @ $59.95 $______
☐ **Lambda/6 2-M Trunk Antenna** @ $29.95 $______
☐ **TE-1 Tone Encoder Pad** @ $59.95 $______
☐ **PSI-9 Port. Power Package** (less batteries) @ $29.95 $______
☐ **PS-1 AC Power Supply** @ $49.95 $______

and the following **standard** crystals @ $3.75 each:______
______ $______

Sub-Total $______ Ind. residents add 4% sales tax: Cal. residents add 6% sales tax:______ TOTAL: $______

All orders shipped post-paid within continental U.S. For C.O.D., Include 20% Down.

NAME ______ AMATEUR CALL ______

ADDRESS ______ CITY ______ STATE & ZIP ______

Payment by: ☐ Certified Check/Money Order ☐ Personal Check ☐ C.O.D.

Note: Orders accompanied by personal checks will require about two weeks to process.

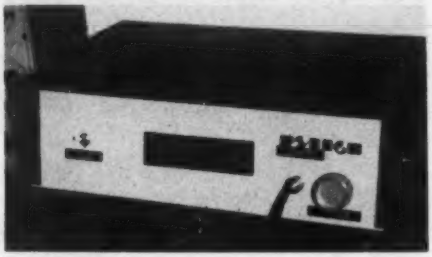
☐ 20% Down Payment Enclosed. Charge Balance To:

☐ BankAmericard #______ Expires ______

☐ Master Charge #______ Expires ______ Interbank #______

Prices and specifications subject to change without notice.

Peter A. Stark K2OAW
196 Forest Drive
Mt. Kisco, NY 10549



The original K2OAW counter.

Latest Counter Update

When I first wrote the article "A Modern VHF Frequency Counter" back in early 1972, I didn't expect anywhere near the enthusiastic response it received. Within a short time I got letters from almost every state as well as a number of foreign countries asking for printed circuit board layouts and further information. In addition to the two printed circuit suppliers listed in the original article, several groups of amateurs in various states have gone into business selling boards at hamfests and club meetings. In short, there are hundreds, and perhaps even thousands, of these counters already in existence.

So now, perhaps it is time to look back at the original design and talk about some modifications and improvements, as well as a few hints and solutions to common problems. But, there is an old Bulgarian proverb (or maybe it's Transylvanian or something) which says – "If it works OK, don't louse it up." In other words, the original design is still sound, and if you are satisfied with its performance, don't change it. With that warning, here goes.

Where to get Information

The original article appeared in three parts: Part I, May 1972 issue of 73 Magazine, carried the basic description and parts list. Part II, July 1972 issue, carried the logic diagrams. Part III, September 1972 issue, had the printed circuit board layouts and parts location drawings. The entire article has since appeared in a Tab book; *RF and Digital Test Equipment You Can Build.*

In addition, 73 Magazine in November 1972 had some corrections, and an article by W9CGI in 73 Magazine for June 1973 had a variety of suggestions on possible modifications. The June 1972 issue of 73 Magazine had an article on a separate VHF frequency scaler using the same Fairchild IC as the entire counter, but using a slightly different circuit. And the March 1974 issue had an article by W4CUG on increasing the speed of the counter.

At the present time, printed circuit board layouts are available from me if an SASE is enclosed. Etched boards seem to be available from many sources, including the following: Westrock Repeater Association, P.O.Box 403, Bedford, N.Y., 10506; and D. L. McClaren W8URX, 19721 Maplewood Avenue, Cleveland, OH 44135. The former is our local repeater association which will put to good use any slight profits it might make on the boards.

Low-Frequency Input Sensitivity

My original prototype had an input sensitivity of roughly 200mV or so on the low-frequency input, but many readers reported being unable to get anywhere close to this figure. We have since built several counters, and all except one had a sensitivity of less than 400-500mV; but that one bad one needed almost 2V to operate properly.

The original design used a 40673 MOSFET in a direct-coupled circuit which had only one isolation capacitor – at the very input, to avoid upsetting the MOSFET bias with any stray dc input voltage. It turned out to be a compromise in an effort to get a simple circuit, with high input impedance, which would work at very low audio frequencies. But direct-coupling from the MOSFET directly into IC1, the Schmidt trigger, forced the MOSFET to operate at very low drain voltage, which is not a very good idea. With the addition of four components, as shown in Fig. 1, it is possible to capacitor-couple the MOSFET to IC1; this allows the MOSFET to operate in a more linear portion of its range and provide more gain. Using a 0.1 μf disk capacitor for coupling, our unit performed down to about 100 Hz with an input sensitivity of roughly 50 or 100mV. The two 1N914 diodes are included to protect the input of IC1 from excessive voltage deviations; theoretically they should be included, although we have operated our unit without them with no damage to the IC. The 2200Ω resistor should be selected, if needed, to make the input voltage into IC1 approximately 1.2V dc with no ac input.

The printed circuit design has no room for these added parts, so you will have to modify it slightly by cutting the copper conductor going from the drain of the MOSFET to pin 4 of IC1. Connect the capacitor across the break in this conductor, and connect the 2200Ω resistor between pin 4 and pin 7 (ground). Measure the dc voltage at the input to IC1, and if it is much different from 1.2V or so, substitute a slightly different resistor value – lower to drop the voltage, higher to increase it. All of these components, as well as the diodes, if you use them, should be mounted on the bottom side of the board.

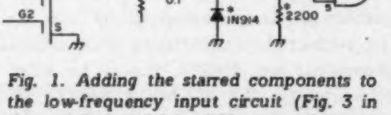
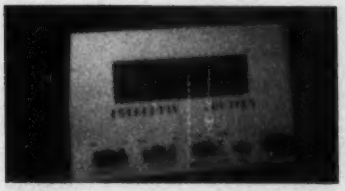


Fig. 1. Adding the starred components to the low-frequency input circuit (Fig. 3 in the original article) yields somewhat improved input sensitivity.

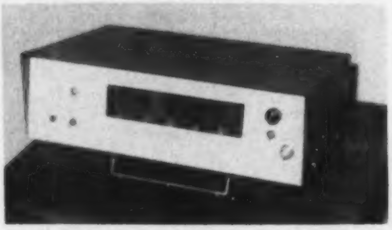


WB2CHW's version of the counter.

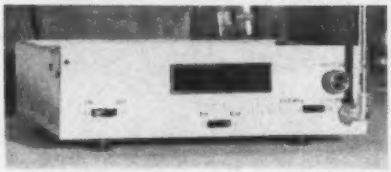
VHF Scaler Operation

Some readers have had trouble with the scaler portion of the counter. The Fairchild 95H90 scaler IC costs $16, and so swapping ICs is not a popular troubleshooting method here! There have been a number of reasons for problems, the main one being that a sizable percentage of 95H90's have been defective right off the production line. Apparently Fairchild had some production problems at the beginning; but rumors have it now that the presently available ICs are better, and so we should see fewer and fewer troubles as time goes on.

The first thing you need is a way of testing the 95H90. This is not easy, since you have to test it under operating conditions and that means building another scaler. If you know someone else who has built the counter, perhaps you can interchange ICs. Another alternative is to build the VHF scaler written up in the June 1972 issue of 73 Magazine. To make sure you don't have other problems with the layout, be certain to use the same printed circuit pattern given in the article; you can make your own or obtain the small board from one of the board suppliers listed earlier. If your IC doesn't work in the simpler scaler circuit, then it's almost a certain bet that the IC itself is bad. (Two comments about the June 1972 scaler. First, make sure to use a good stiff 6V battery – a lantern battery is best. Don't try to use some AA cells, as the IC takes a lot of current. Second – and this is a long story that I won't repeat – the resistor labelled .18K in the article is supposed to be 180Ω.)



WA9FCM's version.



And one built by K5PQK.

And by Don Hoos.

An interesting sidelight is that many readers wrote me to say that the 2N5771 specified in the scaler doesn't exist. Though it is listed in the Allied catalog and should be available from any Fairchild distributor, somehow it seems hard to get. Fortunately there is nothing magic about it, and many silicon PNP switching transistors will work just as well as long as they go up to high enough frequencies – for example a HEP52 or HEP715.

We have also found that the 95H90 IC in the scaler is very temperature and voltage sensitive. In normal operation it runs quite warm, almost hot. You can put your finger on it, but sometimes it is not very pleasant to keep it there for long. Hence, if you adjust the bias pot in the scaler while the unit is cold, it will not work well after everything warms up. The best solution is to cement a small aluminum heatsink to both scaler ICs and let everything heat up before adjusting the bias pot for best sensitivity. Mounting the bias pot on the outside of the case, or at least making sure you have a small access hole in the case that you can stick a screwdriver through to adjust it is also very helpful. But if you mount the pot off the board, make sure to use very short leads, and bypass the pot at the board end with a 0.01 µf disk capacitor.

The scaler ICs are designed for use with *negative* power supply voltages, with pins 4 and 5 grounded, and pin 12 connected to -5.2V ±5%. In practice, most users reverse the connections and then use a +5.2V supply, since this makes it compatible with TTL ICs which need 5V. Since the allowable voltage range is then 5% above or below 5.2V, the IC is *supposed* to work at 5V. But that is not always true – we have run across a number of ICs that needed at least 5.1V, and sometimes even 5.2 or 5.3V. Some people have found that a slightly lower voltage, on the order of 4.9 or so, works better, but that is rare. In any case, if you find your IC is good but it won't work at 5V, try a few tenths more or less. (Note that the scaler in the June 1972 issue of 73 Magazine used 5.3V.) But be careful – the ECL ICs will easily stand up to 5.5V (the catalog says 6, but don't try it) but the TTL ICs are doomed above 5.25 or so (not always, but you've got thirty some ICs on that board so be careful). Adjusting voltage is not very easy with the LM309K regulator, but the alternate power supply in Fig. 18, of the original article is easily adjusted up and down, and will allow you to find the best operating point for the 95H90. If you have to go above 5.1V, it might be a better idea to build a separate supply just for the scaler ICs, and keep the rest of the ICs at 5V.

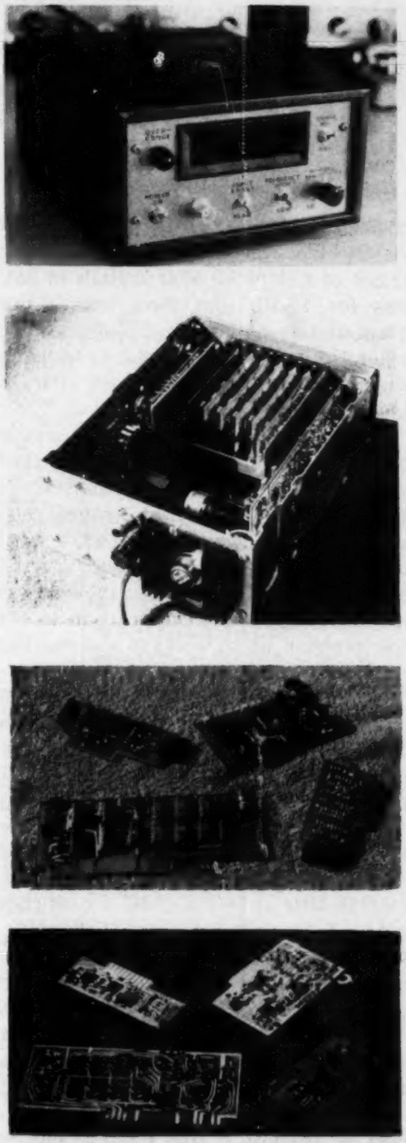
Power Supplies

If you used the LM309K regulated supply, you have already discovered that one of the diodes in the circuit was shorted. But whichever power supply you used, a "crowbar" circuit is a good idea. It is simply a 1A fuse in the 5V power line, followed by a 5.6V hefty Zener to ground. If for any reason the regulator should fail, the Zener blows the fuse. As to other problems – one reader got an LM309K that *oscillated* – the counter did very strange things as a result. The problem had something to do with parts placement; we finally got it to stop by removing the 0.1 µf disk capacitor at the output of the power supply. Still haven't figured out why.

Occasionally, the LM309K does not regulate – its output voltage drops below 5V. Assuming that you don't have a short which draws excessive current, the reason is probably that the output voltage from the rectifier is too low. A 6.3V filament transformer in the power supply provides an input into the regulator of about 9V, which is just above the minimum that the LM309K needs. Occasionally we get just the right combination of low transformer voltage along with a slightly weak regulator, and then it just stops regulating. The solution is to try a different LM309K or a larger 6.3V transformer. The best solution would be to use an 8V transformer, but these are hard to get. Don't do what one reader did, though, running into this problem, he simply switched to a 12.6V transformer, which gave him almost 18V into the regulator. Even though the LM309K was mounted on a gargantuan heat sink, I burned my finger on it when I accidentally touched it. It worked, though.

The final problem is with the adjustable power supply in Fig. 18, of the original article. About three or four readers found that it did absolutely nothing when the scaler ICs were plugged in. As long as the 95H90 was unplugged, everything worked fine. But plug in this IC, and the 5V line went to 0V. Absolutely dead. Shorted IC??? No!

WB2AAQ finally found the solution with his power supply, and his solution has worked for others as well. The problem is caused by the fairly high current drain of the 95H90, combined with a high input offset in the 741 op amp used in the regulator. With the heavy load on the 5V line, the output voltage from the supply starts rising rather slowly. As soon as the voltage reaches a few tenths of a volt, the 741 looks at it and decides that the output voltage is too big – and promptly turns everything off again. WB2AAQ's solution was a very simple one, connect a 1 megohm resistor from ground to one of the 741 IC pins – pick whichever one makes the thing work.



Four views of WB2UKP's version.

Reference Oscillator Stability

Most counters built seem to have a very stable timing reference oscillator. For instance, W4ZUS found it held within 5 cycles at 10 MHz for several hours (and suggested a tubular trimmer for adjustment, as the lead screw gives a vernier effect for adjustment); K7DTS/1 found it held within 20 cycles. Others decided that an oven would give

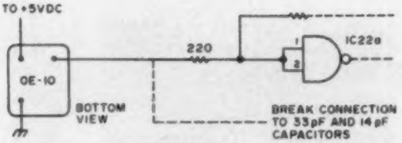


Fig. 2. Connecting the International Crystal OE-10 Oscillator to the crystal oscillator (see Fig. 7. of the orignial article).

better accuracy (WA0ABI suggested that Gateway Electronics in St. Louis had a number of Collins 10 MHz crystals in 28V ovens for $2.50). But there were a few readers who found that the crystal reference oscillator drifted very badly during warmup, though it seemed to settle down after 15 minutes or so.

The problem here seemed to be a crystal which had marginal activity, so that even small changes in operating parameters would result in a great change in frequency. A possible solution would be to get a good quality crystal, such as the HA series crystal from International. But for just a few dollars more there is an excellent solution to the whole problem which works so well that I'm sorry I didn't think of it earlier.

For $19 you can order from International Crystal an OE-10 oscillator assembly, which is a complete oscillator, with crystal. If you specify 5V operation, they will even put it on frequency for you and give you a listing of drift against temperature. The unit I got was certified at 10.000026 MHz at -10°C (14° F), 10.000004 MHz at +25°C (77° F), 9.999958 MHz at +60° C (140° F), which is roughly .5 Hz drift per degree Fahrenheit. The rated temperature stability over the range from -10 to +60°C with respect to "room temperature" of 25°C is given as 0.0005%, while the tolerance *as shipped* is within 0.0001% at 25°C. All of this in a metal can roughly an inch square! No need to resort to ovens; in fact I didn't even bother to readjust it after receipt, since it seemed as close as I could use. And connecting it to the counter is done with three wires, as shown in Fig. 2. It is only necessary to lift one end of a 220Ω resistor off the board, and connect to it. Although the 33pf and 14pf capacitors and the crystal could be removed from the board as they will no longer be needed, I decided to leave them just in case I wanted to switch oscillators in the future.

Control Circuit Operation

Two types of erratic operation of the control circuits have been observed by readers. In one case, observed by two or three persons, the reset circuit sometimes operates sluggishly or not at all; this is remedied by increasing the value of the 100pf capacitor connected to pin 3 of IC32a (See Fig. 10, of the original article) to a larger value such as 200 or 500pf.

Another interesting malfunction was found and solved by W2CLL; I have since run across about three or four other counters with the same problem. In Bob's unit, when in the Hz position, the counter would provide the correct reading for one second, followed by a second of 00000, rather than showing the correct reading for a full two seconds before the next update. This was caused by an extra strobe pulse sneaking in at a time it shouldn't.

As shown in Fig. 11, of the original article, the S and RC (or CR signal, as it is called on Fig. 10), should be exact opposites of each other. But this isn't so, since the RC signal has to travel through a few more flip flops than the S signal in the Hz position. As a result, the S signal gets to IC32d sooner than it should, and forces IC33b to quickly set and reset at a time when it should stay reset; this generates an extra strobe pulse at the wrong time. I must apologize for this little mistake in the original design, but fortunately it only happens with just the right combination of ICs; hence only a handful of units actually have had the problem. The solution is very simple – slow down the S signal by putting a 470pf capacitor from IC31d pin 11 to ground. Actually, anything that slows down the S signal a little will work, including a small capacitor from any one of the pins of IC33b to ground.

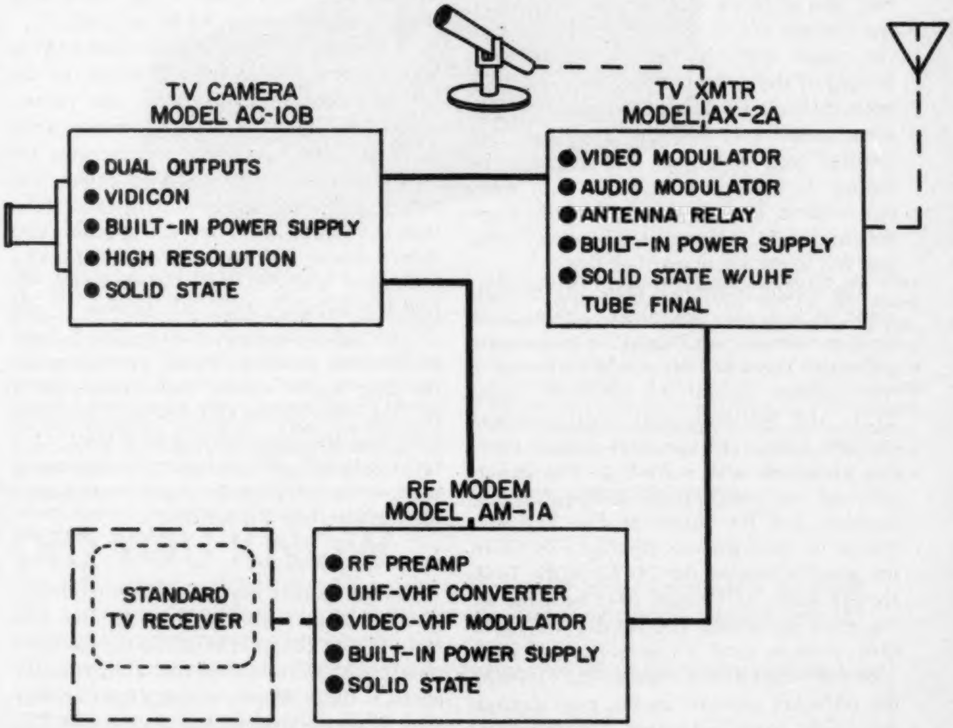
Readout Selection

When I wrote the original article, I correctly predicted that the price of LED 7-segment displays would drop by the time the article appeared in print. It is now possible to get LEDS for as little as $3 a

FAST SCAN AMATEUR TELEVISION

NOW you can enjoy FSTV at reasonable cost. NOW available — a COMPLETE FSTV equipment line.*

*** U.S. made with parts available from your local electronic parts distributor.**


TV CAMERA
MODEL AC-10B
● DUAL OUTPUTS
● VIDICON
● BUILT-IN POWER SUPPLY
● HIGH RESOLUTION
● SOLID STATE
TV XMTR
MODEL AX-2A
● VIDEO MODULATOR
● AUDIO MODULATOR
● ANTENNA RELAY
● BUILT-IN POWER SUPPLY
● SOLID STATE W/UHF TUBE FINAL
RF MODEM
MODEL AM-1A
● RF PREAMP
● UHF-VHF CONVERTER
● VIDEO-VHF MODULATOR
● BUILT-IN POWER SUPPLY
● SOLID STATE
STANDARD
TV RECEIVER

For detailed technical information and pricing — write to:

APTRON

Dept AMTV
P.O. Box 112A, R.R. 2
Bloomington, Indiana, 47401

piece, which is less than the comparable incandescent readouts. Hence a number of the counters have been built with LED readout. But this has led to two problems.

First, the Numitrons generally sold for $4 or so are priced very close to their list price, hence you are probably getting a new unit that has passed all the inspection steps. On the other hand, the $4 or so LED is probably a reject or at least has a questionable origin. That means you may get a dud. Watching out for words in small print like "no chance to test them" etc., is a help, but even that doesn't work. I paid $7.95 each for my Litronix LEDs in the original counter; so far three of the five have gone bad, and all in the same way – the element has shorted out to the decimal point, with the result that the decimal point lights instead of the e. And on top of it all, it has been difficult to get replacements cheaply, since until recently you couldn't tell whether you would get the Litronix, an Opcoa, or perhaps a Monsanto unit when you ordered the $4 special. Since the numbers look a bit different, the only way to be safe was to get a new set of all five.

The second problem is that LED readouts come in basically two types – those with common anodes, and those with common cathodes. The 7447 decoder/drivers used in this counter require the *common anode* LED, and will not work with common cathode LEDs. The common cathode units can be driven with a 7448 decoder/driver, although the 7448 was not designed for that purpose. Use the circuit of Fig. 3 if you choose to use common-cathode LEDs. Since the pin numbers on the 7447 and the 7448 are the same, no changes need be made on the main pc board. The display will be a little dimmer than a common-anode LED with the 7447 but don't reduce the values of the 680-ohm resistors as this may damage the 7448 driver. (Another LED readout, containing an array of dots, isn't seven segment and therefore would require large changes in the counter board – don't use it unless you are willing to change the layout.) Since most of the LED advertisements compare the LEDs sold with the Monsanto MAN series, Table 1 gives some information on these units.

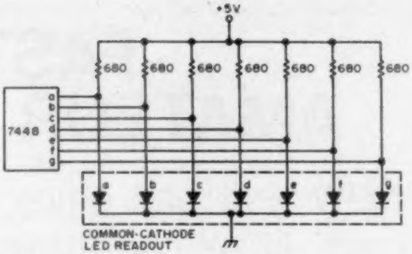


Fig. 3. Connection of a common-cathode LED readout to a 7448 decoder-driver.

Several readers have asked how to interface Nixie tubes with the counter; although this is not recommended, a layout for Nixie tubes (using unknown Nixies with wire leads) is available from me for an SASE.

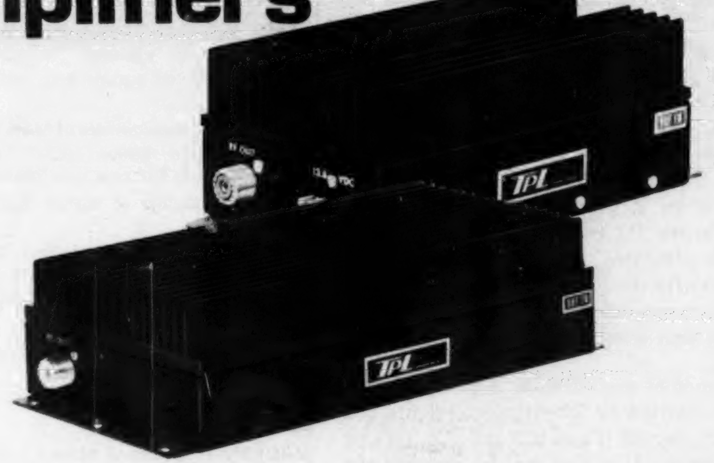
A number of readers have asked how to add three more readout indicators to the counter. This modification is not recommended to anyone who has to ask how to do it. First of all, the drive requirements for strobe and reset pulses are marginal, the power supply is marginal and the extra three indicators don't really tell you anything you didn't know before. In fact, the extra indicators will only read when in the Hz position anyway, since the counter is not fast enough to read out in more than 5 digits in the kHz position. Hence you are automatically stuck waiting two seconds for a reading, when in the kHz position you could have had the same reading in a tenth of a second. Finally, it requires major changes to the printed circuit board, and hence seems more effort than it is worth.

Other Modifications

Several readers have asked for a modification to extend the range to at least 450 MHz. As the cheapest IC to do the job right now costs $55, I have not even thought about it twice. Plessey makes a flip flop that goes above 1000 MHz, but costs over $100; all of you readers out there are invited to try your luck with these – not me. It should be possible to build a flip flop that goes to 450 MHz out of discrete components (tunnel diodes, perhaps), but that appears to be a difficult job.

Several readers have suggested that the first decade divider in the counting circuits

now available ...TPL VHF-UHF power amplifiers



TPL brings you the finest amateur RF amplifiers for VHF FM available today. Only state-of-the-art techniques in circuit and semi conductor technology make an amplifier of this quality possible.

The amplifying transistors are of the balanced emitter silicon power type. Each one is individually checked for power output and reliability during mismatch conditions. They are operated well within the factory's suggested limitations for added reliability and life. Most circuitry is of micro-strip technique for stability and broadband characteristics. Antenna switching is accomplished through the use of a specially selected RF relay . . . activated by only one watt of RF power through an RF sensing circuit. During receive, the antenna by-passes the amplifier and is fed through the relay to the transceiver. Also of note is a reverse voltage protection diode which protects the power transistors from destruction in the event the amplifier is connected to the wrong polarity. TPL amplifiers are simple to install and fool-proof to operate. With proper care, they will provide a lifetime of dependable service.

DID YOU KNOW...

TPL is the largest manufacturer of accessory solid state RF power amplifiers in the world.

TPL commercial amplifiers are used and recommended by every major manufacturer of commercial communication equipment.

TPL's engineering staff contributed to the development of RF power transistors from their earliest inception.

TPL offers the broadest selection of RF power amplifiers.

TPL offers the highest quality RF power amplifier available.

TPL guarantees its amplifiers against defective parts and workmanship for a full year.

TPL power amplifiers and repeater amplifiers are now available at your local dealer.

talk power by TPL
COMMUNICATIONS INC.
13128 YUKON AVENUE / HAWTHORNE, CALIF. 90250 / (213) 679-0131

(IC5 and IC6) be replaced by a faster IC, such as perhaps a Schottky 74S73. This seems like a fairly good idea, except that I haven't done it yet. This method should extend the low-range to perhaps 80 MHz; a simple ECL flip flop would then double the range to 160 MHz without the need for a $16 scaler IC, enough to cover the 2m band. But the scheme has two disadvantages – it doesn't cover 220 MHz, which the 95H90 does, and it also requires the redesign of the MOSFET/Schmidt trigger input circuit, since the 7413 is not available in a Schottky version. Further, to get a direct frequency readout, it requires some additional switching in the time chain dividers to give an extra division by 2, which lengthens the readout time in the HZ position to 4 seconds. This idea is presented to those readers who wish to make the modification, but as before, it is not recommended by me for the simple reason that it seems more effort than it is worth.

A simpler modification is to replace IC4 and IC5 with their Schottky equivalents, and then try several ICs as IC3 and IC6, picking the fastest. This can greatly improve the frequency range via the low frequency input. See the article by W4CUG in the March 1974 issue of 73 Magazine.

Finally, in his article in the June 1973 issue of 73 Magazine, W9CGI suggests several changes to improve the counter. The one given as Fig. 1, in his article is not recommended, as it violates TTL design rules. But the one in his Fig. 3, has merit, if we connect the left end of the 10K resistor to IC33a pin 15, rather than IC29 pin 11. When the counter is in the Hz position the added indicator will blink on for one second, and off for one second. It then indicates that the counter is counting when the light is on. This is a very worthwhile addition, since it enables you to make slight circuit adjustments when the light is off, and then use the next count interval to give you the next reading. I have used this technique (without the light, though) for adjusting 2m FM transmitters on frequency. The fine adjustment is done in the Hz mode, at which time you have one second for making slight adjustments, followed by one second of frequency indication. This trick enables you to make one adjustment every two seconds, with no false readings in between.

To close these comments, let me again repeat the comment made at the beginning, "If it works OK, don't louse it up." If you already have a counter which works, and works to your satisfaction, then leave well enough alone. The original design was basically sound, and there is no reason to fiddle with a counter which works well. Instead, pride yourself on having a good reliable piece of equipment, which you have built yourself.

[illegible]

TABLE I Characteristics of MAN LED Readouts

MAN-1 – Red, 69mm (0.27") high numbers, common anode, DIP case, uses 7447 driver.

MAN-1A – Similar to MAN-1, but darker – has red epoxy case.

MAN-1B – Similar to MAN-1, but different decimal point connection.

MAN-1BA – Similar to MAN-1B but red epoxy case.

MAN-1001 – Similar to MAN-1 but only displays +, -, or 1.

MAN1001A – Similar to MAN1001 but red epoxy case.

MAN1002 – Similar to MAN-1 but intended for hexadecimal display; can be used in counter same as MAN-1 but don't try to use decimal point.

MAN1002A – Similar to MAN1002 but red epoxy case.

MAN-2 – Alphanumeric display consisting of dots. Don't use.

MAN-2A – Similar to MAN-2 but has red epoxy case.

MAN-3 – Red, common cathode, 29mm (0.115") high numbers, flat case with different pin connections from MAN-1, uses 7448.

MAN-3A – Similar to MAN-3 but has red epoxy case.

MAN-3M – Similar to MAN-3A but has different pin arrangement.

MAN-4 – Red, common cathode, needs 7448, 48mm (0.19") high letters, DIP case but different pin connections.

MAN-5 – Green, otherwise similar to MAN-1.

MAN-6A – Red and 1.42cm (0.6") high numbers, a wide DIP-style case, but otherwise similar to MAN-1A.

MAN-66A – Similar to MAN-6A.

MAN-8 – Yellow, otherwise similar to MAN-1.

MAN-10 – Similar to MAN-1, requires slightly less current.

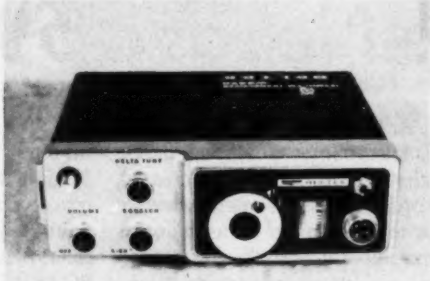
MAN4001 –Similar to MAN-4 but only displays +, -, or 1.

ANNOUNCING

BELTEK W3470

ONLY 12 XTALS NEEDED
FOR 24 CHANNELS!

NICADS SUPPLIED



THE NEWEST PORTABLE TWO METER FM RIG

SPECS ABOVE AVERAGE

AVAILABLE SOON

AUDIO LAND has a complete ICOM line in stock for

immediate delivery

Also in stock – BELTEK W5570 (uses TR-72 xtals for transmit and receive)

For more information write

AUDIO LAND MEN OF MUSIC INC
36633 S. Gratiot
Mt. Clemens Michigan 48043
313-791-1400
Attention: Amateur Sales Dept.

William P. Turner WA0ABI
Five Chestnut Court
Saint Peters MO 63376

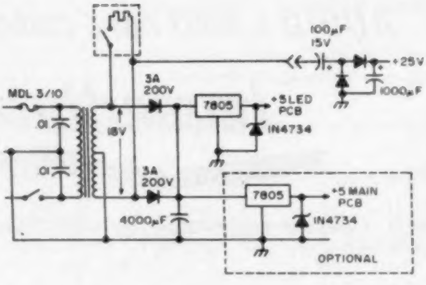
Who Needs a 5V Supply ?

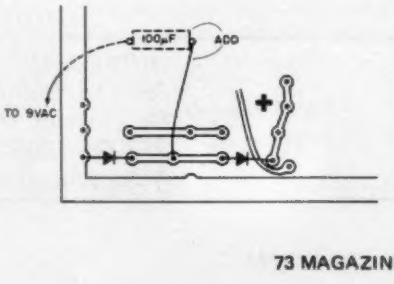
K2OAW counter builders do, for one.

The K2OAW counter published in 73 during the summer of 1972 has created a great deal of interest in counter construction. I know personally of a half dozen already completed and perhaps another dozen in various stages of construction. Every time the subject comes up there seems to be considerable interest in the modified power supply I use on my counter. The changes are nothing unusual but they do make for a simpler, more compact unit.

At the outset it should be known that my counter includes a surplus Collins crystal-oven for the time base which required a source of heater voltage in addition to the normal requirements of the counter proper. The counter requires 5V regulated at slightly over 1A and 20–30V at a few mA for the input amplifier. The oven in use requires 28V at 1A according to the nameplate. I used an 18VCT transformer at 2A to supply all of the above. The entire winding is used to heat the oven, while this is less than the stated voltage the oven starts cycling in approximately four minutes. . .which is satisfactory. The winding is full-wave center-tap rectified and applied to Fairchild (or equivalent) 7805 IC regulators to provide the 5V for the LEDs and logic. It would be safer to provide separate regulators for the two functions but my counter has worked nicely for over a year with a single 7805. LM309K regulators would work as well if they are more readily available. I personally prefer the 7805 due to the relative ease of mounting the TO-220 case as compared to the TO-3 of the '309K. The 20V for the 40673 input amplifier is provided by a voltage doubler working off half of the winding. The series capacitor is added to the main counter PC board immediately in front of the existing 1000µF electrolytic. Jumper wire under the board connects the capacitor to pads originally intended for the bridge rectifier. Only two diodes are now required. The 5.6V Zener was added to the output to act as a crowbar to insure the primary fuse will blow if a regulator were to fail.

. . .WA0ABI





Alan Shawsmith VK4SS
35 Whynot Street
West End 4101 QL
Australia

How To Win A Big Contest

To win an Indy 500 or Grand Prix one would need more than average luck. You must have a good car that is super tuned and be in good shape yourself. To make it in the Top Ten of WW contest one must have a rabbit's foot (or whatever), a rig that's working smoothly and be able to do the 48 hour stint 'in a breeze.'

Many hams who make it to the immortal plane of the fortunate few, don't have a $10,000 set up or a 10kW linear in the ceiling. Nor do they have 10-elements stacked up 30.5m (100'). Their rig and antennas are mainly standard commercial products often running at less than the full gallon. How then do they tote up such fantastic scores? Well, if it's not a 'freak' QTH, then it must be the operator who has that something extra.

Contest caperers come in two types. There's the casual 'goer' who's only in it for a few new countries or prefixes; knows he can't figure in a place but just wants to help swing the scene along a little. The other is a 'fair dinkum' trier whose mind is fixed on a tangible reward such as wallpaper, a medal or plaque etc.

Those who finally make it to the Top Ten are:

1. Under fifty years of age. There are exceptions but OT's by reason of advancing years are handicapped out of a two day 'sweat.'
2. Are fast, efficient and have a smooth operating technique.
3. Able to go non-stop all the way without brain 'fag.' This is where the 'extra' comes into play and the men begin to show out from the boys. Human stayers are like racehorses, born rather than trained. But many who do have this stamina and ruin it by their approach and 'modus operandi.'

It's easy enough to stay awake for a weekend but to remain alert all this time while riveted to the rig and having your head pounded by QRM is a different matter altogether. Concentration is intense and the amount of mental energy expended is staggering. No wonder fatigue finishes off so many.

To excel, one must be fit. To assume that because amateur radio contesting is a sit-down struggle good physical shape doesn't count is a bad mistake. Those with good muscle tone 'stay' long and well. Like the rig he owns, each person knows best how to tune himself up. But six weeks jogging before a big 'scrap' should bring him to the rig on the gong, fit enough to eat it rather than work it. These ops are already half way there.

No boxer goes the distance without those vital between round rests – and they're just as important in a 48 hour contest. Those who cannot pace themselves fail. A short break away from the rig once every hour is a must. Resist the temptation to stay even if the whole band is calling. Get up and walk around for three or four minutes until your circulation is restored to full bore. Then return to the fray with concentration renewed and muscles relaxed.

If sleepiness is your problem, maybe it's best not to make the operating chair too comfortable. However, remember, physical discomfort saps concentration. So the idea is to sit 'loose.' A foot rest, a fairly low desk on which the arms hang slack at ease, a chair with an adjustable back support and all controls within effortless reach. All of this will add 5% to the total score.

All right, so you and the rig are GO. But don't forget that Lady Luck still holds the trump card. Without her favors you're an also ran. There are two sorts of luck and you'll need all that's going of both. It is vital to get away to a good start; fast flowing QSOs and not too much QRM. One must be up with the field at the half way mark to have any chance. Unlike many competitions, it is almost impossible to come from behind at the end and win. Also in any WW 'scrap' ionospheric conditions vary considerably between hemispheres and continents. It may happen that from your QTH all circuits on all bands to Europere out. Such a loss in DX and activity may be too much to lose.

Relaxation should be the aim for a day or so before a big contest. But many hams, excited at the prospects and urge to do better, go crazy and attempt impossible tasks. Some have the compulsion to change their sky-hooks and find right on starting time that the SWR is like their blood pressure – sky high. Others drive long distances to an S9 Eldorado and by the time the antennas are up, the gear assembled and the snags out, they're ready for bed not a contest. Some decide on last minute rig modifications. Anything from building a new final to attempts to sharpen i-f selectivity. The bell goes and half the equipment is still in pieces on the table. When minor adjustments can have disastrous consequences. I once went out to tighten a slightly slack leg of my 80/40m inverted Vee. It broke off right at the apex. When I attempted to lower the aerial I found that the pulley wheel at the top of the mast was rusted. Profanity in several tongues proved useless, so that was that. Moral: HAVE EVERYTHING TESTED AND READY DAYS BEFORE ANY BIG EVENT. EVEN IF SOME SMALL THING PROVES TO BE AMISS ON COUNTDOWN, LEAVE IT IF YOU CAN.

A weekend international contest is a hard road and it takes an old dog who knows all the tricks (ethical ones), to win. Psychological pressure plays a part. You must appear to be 'movin' it along' at all costs. If the mode is A1 send as fast as conditions allow. Sound slightly aggressive. Don't struggle with QRM, change frequencies. Never be turned off by a high scoring competitor. He may be a phoney, the results sometimes show this to be the case.

If the rules of a contest make it permissible to commence with any three number digit between 001 and 100, it is often wise to let a few minutes of the 'scrap' get under way and then kick off with a fairly high number around 070. The idea is to keep the true score to yourself and confuse others. Study the form of previous contests and be 'teed' up on who the opposition might be and the likely scores. Check the Iono charts for MUF times and best, use of all the bands. If you are a brass pounder vary the BFO tone regularly to ease brain 'fag.'

Keep a spare transceiver on hand, even if only a QRP job. Unless you are dead sure the race is lost never drop out. At all costs finish well; it might just nudge you into a place.

There are those cool contesting 'cats' who claim to use a keeper of the log. This extra hand and two ears is worth, they say, an added 10% in QSOs. Adjudicators might consider this a form of cheating but it's a breach impossible to police. This Man Friday help may work o.k. on phone where the digits given are an oral exercise but in my experience on CW it is NO GO combination. The pace is so hot and the QRM so thick, mistakes continually occur.

Hams, like all others, are drawn to an activity that throws up a challenge. And contesting is truly a stiff test of skill and stamina. There are many WW 'meets' each year and the fields in all continue to grow. There are the old familiar calls and the new. It's great to make it in the Top Ten but better still is the satisfaction that comes by taking on all comers.

. . .VK4SS

THE NEW ITC AR-2000 RECEIVER. IT'S SO SELECTIVE IT DOESN'T KNOW WHAT INTERFERENCE IS.

The AR-2000 is a completely solid-state, dual-channel communications receiver with 0.15 uV sensitivity (10 dB S+N/N) and selectivity that renders it virtually interference-proof (more selective than you ever thought a receiver could be). Blocking, intermodulation, adjacent-channel and crossmodulation rejection characteristics are better than any other receiver on the market and are typically beyond the scope of measurement.

This plus: modular construction; digital frequency readout; all bands (160m-10m) in 1 MHz ranges; two independent channels for dual receive, transceive-plus-receive or split-frequency operation; adjustable IF Passband (to within 100 Hz); 16-pole filter for over 200 dB skirt selectivity (standard 2.1 kHz BW, shape-factor 1.4:1); adjustable-Q/adjustable-frequency Notch and Peak Filters; adjustable-threshold noise-blanker; Receiver-Incremental-Tuning; and many other features found in no other receiver. Introductory price: $1,250 with **two-year** warranty.*

The AT-2000 matching transmitter is completely solid-state, provides adjustable output power from 1W to 175W, requires no tuning, can be remotely operated by the AR-2000, has a built-in RF Speech Processor, VOX, Sidetone and Heavy-Duty Power Supply. Introductory price: $945 with **two-year** warranty.*

***Warranted to be free from defects in materials and workmanship. Factory or authorized dealer repairs at no cost to owner for two years from date of purchase.**

The ITC AR-2000 Receiver and AT-2000 Transmitter—performance that challenges your imagination.

INTERNATIONAL TELECOMMUNICATIONS CORP.

P.O. Box 4235, Torrance, Calif. 90510 • (213) 375-9879

Warren L. MacDowell W2AOO
11080 Transit Road
East Amherst NY

Digital Wind Direction Indicator

Impress your friends – aggravate the XYL.

With the appearance of inexpensive and reliable magnetic reed switches on the surplus market, a digital wind direction indicator becomes quite easy to construct.

Magnetic reed switches are activated in the proximity of a magnetic field of sufficient intensity. Inexpensive ceramic magnets are readily available as magnetic memo holders, etc. These ceramic magnets, when placed near the reed switch, will cause it to "make" or close its contacts. The reed switches used in this wind direction indicator were purchased from Radio Shack in a pack of 10 for a little over $1.00.

By mounting magnetic reed switches in a circle and rotating a magnet about the inside of the circle, the switches will close as the magnet passes near them.

The rotating magnet system lends itself perfectly for construction of a wind direction indicator. If an "arrow" capable of following wind direction is used to drive the rotating ceramic magnet, appropriate switches would be closed thereby supplying wind direction data.

Our rooftop indicating device was constructed from a burned out muffin fan (rotron fan). The inside fan blades were ground off leaving only the rotating center piece. The ceramic magnet was bolted to the outer edge of this center section. With the use of a muffin fan your 'bearing" surfaces are already made up and this saves considerable design work. The wind "arrow" was constructed from ¼ inch copper tubing and tin can metal stock (see Fig. 1). This is attached to the center rotor with a metal plate and bolts. No doubt, other magnet rotating wind arrow devices can be created, however, the muffin fan assembly lends itself perfectly. After the arrow section is completed, a plastic protective spray should be applied to prevent weather corrosion, etc.

The magnetic reed switches are positioned at equal 45° intervals in a piece of ¼ inch plastic attached to the outer shell of the

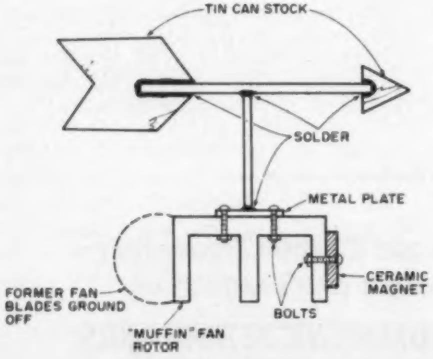

TIN CAN STOCK
SOLDER
METAL PLATE
CERAMIC MAGNET
BOLTS
FORMER FAN BLADES GROUND OFF
"MUFFIN" FAN ROTOR

Fig. 1. Wind direction rotor assembly.

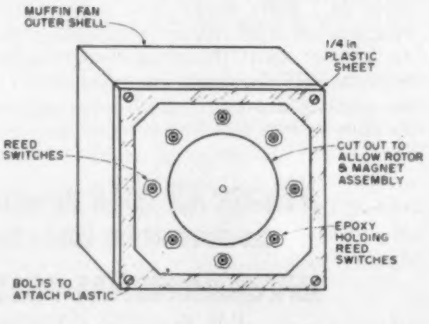

MUFFIN FAN OUTER SHELL
1/4 in PLASTIC SHEET
REED SWITCHES
CUT OUT TO ALLOW ROTOR & MAGNET ASSEMBLY
EPOXY HOLDING REED SWITCHES
BOLTS TO ATTACH PLASTIC

Fig. 2. Mounting of reed switches.

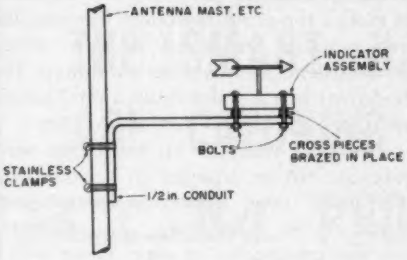

ANTENNA MAST, ETC
INDICATOR ASSEMBLY
BOLTS
CROSS PIECES BRAZED IN PLACE
STAINLESS CLAMPS
1/2 in. CONDUIT

Fig. 3. Indicator to mast attachment.

muffin fan. The plastic was drilled so as to admit the reed switches and they were held in place by epoxy cement. It is necessary to plan the position of the switches before mounting them permanently so as to insure that they will be activated by proximity of the rotating magnet. (See Fig. 2.)

In order to attach the muffin fan assembly to an existing rooftop mast, a bracket must also be devised. One-half inch steel conduit was bent so that stainless steel clamps could hold it to a main mast and it would extend out at a 90° angle. Two cross pieces of ½ inch conduit were then brazed to the main ½ inch stock so that bolts inserted through the muffin fan frame could hold the entire assembly in place. (See Fig. 3.)

Transmitting the reed switch information from the rooftop indicator to an inside readout device would normally require quite a cable (9 wires). With binary or digital techniques, common four wire television rotor cable will convey all the necessary data.

In binary notation, eight different wind directions are represented as 0-7. Therefore, 0 = NW, 1 = N, 2 = NE, 3 = E, 4 = SE, 5 = S, 6 = SW and 7 = W. Considering that 0 requires no reed switch, only seven switches are required in the rooftop indicator with one blank position (0 or NW). If you will observe Fig. 7, it illustrates how ground and + 5 VDC coming down the A, B and C rotor wires represent actual numbers or indicators when translated by the digital decoders (Fig. 5). The fourth (spare) rotor wire is at ground potential.

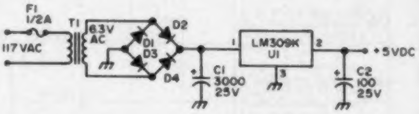

F1
1/2A
T1
117VAC
6.3V AC
D1
D2
D3
D4
C1
3000
25V
1
LM309K
U1
2
3
C2
100
25V
+5VDC

Fig. 4. 5V power supply. D_1 - D_4 – IN4002 Silicon Diodes. T_1 – 117AC to 6.3 AC at 1 amp. filament transformer. C_1 – 3000 μF,25V elec. capacitor. C_2 – 100 μF, 25V elec. capacitor. U_1 – LM309K voltage regulator (5VDC).

The SN7442 decoder (Fig. 5) translates the binary data back to decimal indications. The SN 7404 inverters "turn on" the driver

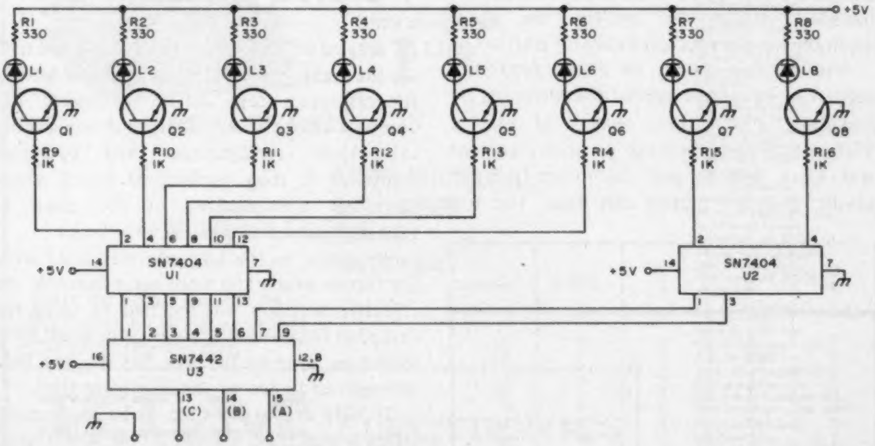

+5V
R1 330
R2 330
R3 330
R4 330
R5 330
R6 330
R7 330
R8 330
L1
L2
L3
L4
L5
L6
L7
L8
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
R9 1K
R10 1K
R11 1K
R12 1K
R13 1K
R14 1K
R15 1K
R16 1K
SN7404
U1
SN7404
U2
SN7442
U3
+5V
14
7
16
12,8
2
4
6
8
10
12
1
3
5
9
11
13
1
2
3
4
5
6
7
9
13 (C)
14 (B)
15 (A)

Fig. 5. Decoder and readout. U1-U2 – SN7404 Integrated Circuit. U3 – SN7442 integrated circuit. Q1-Q8 – 2N3641 NPN transistors. R1-R8 – 330 ohm, ¼ watt resistors. R9-R16 – 1000 ohm, ¼ watt resistors. L1 – L8 – Red LED indicators (most surplus houses).

transistors which in proper sequence illuminate the LED direction indicators.

To convert the 7 reed switches (and absence of a reed switch or blank position) to binary data, a diode matrix becomes necessary. (See Fig. 6.) Almost any silicon diode, such as the 1N914 or 1N4148, can be pressed into service in this matrix as the voltages and current required are quite low.

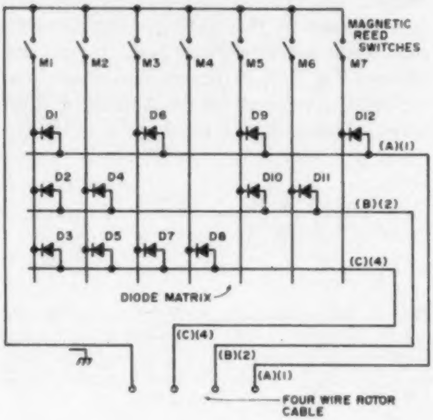


Fig. 6. Diode matrix. D_1-D_{12} = IN914 or IN4148 silicon diodes. M_1-M_7 = magnetic reed switches. (Radio Shack – 10 for $1.19.)

Our particular diode matrix has constructed on a small printed circuit board and installed inside the muffin fan outer assembly on the rooftop indicator unit.

The bottom section of the rooftop indicator can be sealed against the elements by installing a "bottom" piece of plastic. Silicon sealing compound or epoxy cement will work well to seal the joints between plastic and the muffin fan base. The top section of a plastic gallon jug will work well to make a top protective cover, however, the reed switches are sealed in glass which protects them from weather conditions. The diode matrix was sealed inside a small plastic parts box to protect it from the weather.

C 4	B 2	A 1	ACTUAL NUMBERS	INDICATORS
0	0	0	0	N
0	0	1	1	NE
0	1	0	2	E
0	1	1	3	SE
1	0	0	4	S
1	0	1	5	SW
1	1	0	6	W
1	1	1	7	NW

Fig. 7. BCD logic table. 0=ground. 1=+5 VDC.

The LED readouts on the inside wind indicator can be arranged in a circle with appropriate wind directions applied with decals of the "press type." Our indicator box was constructed of clear plastic with a white plastic front which contained the circle of indicator LEDs.

This entire unit is quite simple to construct and is reasonably inexpensive, considering the cost of surplus market integrated circuits. Creativity is essential as well as a well stocked junk box or local surplus electronics store.

The digital wind direction indicator is another device which will aid in cluttering up your ham shack, assist you in spending money, aggravate your XYL due to construction time and impress your friends when viewing this spectacular creation.

. . .W2AOO

Emergency Ferrite Beads

In cases of TVI, a ferrite bead slipped over the base, collector, grid or plate lead of the offending stage can be a lifesaver. The compact choke is also utilized in top-quality laboratory oscilloscopes and spectrum analyzers to stop oscillations which sometimes go unrecognized as the cause of excessive power dissipation in a device.

Recently in the lab, a sudden need arose for ferrite beads and none were in stock. An effective solution was reached by using the threaded ferrite tuning slugs from small VHF inductors. One useful type has the hex hole throughout to accept the alignment tool.

If VHF frequencies are to be suppressed, select a slug from a surplus coil which has 3 to 5 turns, to insure that the ferrite material is appropriate for that frequency range.

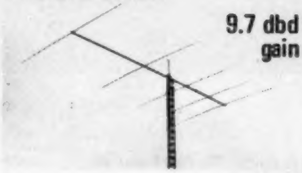
. . .W4ATE

THE SMART HAMS ARE CATCHING ON

KLM PRODUCTS

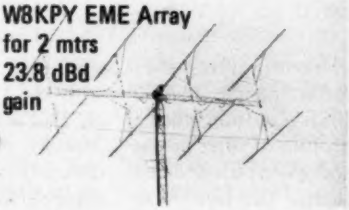
DO GIVE YOU THE EDGE!

THE BIG STICK



9.7 dbd gain

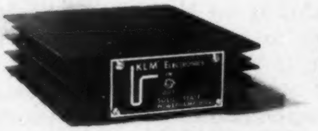
5EL 20 mtr. mono bander
KLM 13.9-14.4-5



W8KPY EME Array
for 2 mtrs
23.8 dBd
gain

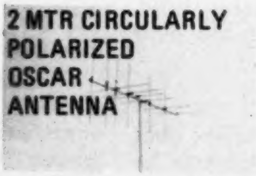
8 KLM 16EL 2 MTR
ANTENNAS (KLM 144-148-16)

10 WATTS IN



2mtr Amplifier
PA 10-140B

140 WATTS OUT



2 MTR CIRCULARLY
POLARIZED
OSCAR
ANTENNA

KLM 140-150-12C

Write for complete catalog or check with KLM's growing list of distinguished dealers.

KLM ELECTRONICS
1600 Decker • San Martin, California 95046
408) 683-4240

NEW DEALERS

Bratty Communications
2196 Colvin Blvd.
Tonawanda NY 14150

Identicorporation
16 East 52nd Street
New York City NY 10022

J. H. Electronics
254 Captains Drive
Babylon NY 11704

D. R. Griffin and Assoc Ltd.
So. 5199 Bussendorfer Road
Hamburg NY 14075

OHIO

Challenger Electronics
1700 Central Avenue
Middletown OH 45042

Communications World
4788 State Road
Cleveland OH 44109

Queen City Electronics
1583 McMakin Avenue
Cincinnati OH 45231

Kelly Scheimberg
7379 Calmcrest Street
Dayton OH 45424

OKLAHOMA

Cals Radio
3rd & Davis
P. O. Drawer F
Tipton OK 73570

Larry M. Dillard WB5CWB
2624 SW 69 Street
Oklahoma City OK

PENNSYLVANIA

Hamtronics
4033 Brownsville Road
Trevose PA 19047

TEXAS

J. P. AshCraft
5641 Dyer Street
Dallas TX 75206

Trimble Electronics
1916 Mary Ellen
Pampa TX 79065

Kennedy Associates
2615 Rigsby Avenue
San Antonio TX 78222

OTHERS

Stereo City Inc.
481 Highland Avenue
Augusta GA 30904

Preston Electronics
611 Highland Drive
Houma LA 70360

Ray Liby
2112 So. Burdick
Kalamazoo MI 49001

Multitone Electronics Inc.
One Cornell Parkway
Springfield NJ 07081

Juniper Photo Electronics
2948 SW 29th Street
Redmond OR 97756

FOREIGN

Ing. Hans Schulze Ltd
P.O. Box 4155
San Jose, Costa Rica

Gemini Electronics Ltd
P. O. Box 5899
Auckland, New Zealand

Electronica Fernandez
208 Eleanor Roosevelt Street
Hato Rey, Puerto Rico 00918

West Indies Sales Co.
606 Calle Aboy
San Juan, Puerto Rico 00907

Omnicom
Hinterrotheweg 15
Switzerland

Lou Macknik W8KBC
96 Fernwood Avenue
Dayton OH 45405

Build a 2m Frequency Synthesizer

Complete construction details.

Part II

Part I (published last month) of this series gave a general description of the FS-220 frequency synthesized HT-220. It included a block diagram and just a hint of what the rig contains. In Part II I will give you a detailed description of the circuitry and how it all works together.

Reference Oscillator

The reference oscillator for the FS-220 is an AT-cut series resonant 10 MHz crystal in virtually the identical circuit used by K2OAW in his frequency counter and frequency synthesizer ("Frequency Synthesizer for 2m FM, Part II," 73, October, 1972). Reference his article for this and other circuits to come.

10 MHz Divider Chain

The 100 kHz square wave for the clock generator and the 1.111 kHz reference for the phase detector are derived from the 10 MHz crystal oscillator through a four stage divider shown in Fig. 2.

Phase Detector

The phase detector presently in use in my rig is the one described by K2OAW (October, 1972, 73). A 0.47 μf capacitor was used for creating the triangular wave with the 1.111 kHz reference. I didn't have an MFE3002 MOSFET, so I substituted a 2N4351. Although the base connections are different it works well and is a few pennies cheaper. Everything else is the same as given by K2OAW. I also tried other phase detectors, including the MC4044P (Motorola). I was able to reduce the reference signal feed-thru to an acceptable level using one stage of active low-pass filtering. This discreet component detector is, however, more desirable since it uses fewer components in the long run.

Unlock Detector

I used the unlock detector from K2OAW's synthesizer also, since the one which was originally designed for the IC detector is not fully compatible with the sample-and-hold type of phase detector. I did not use the LED lock indicator as suggested by K2OAW. Instead, I connected the blanking lead from the 5-digit Minitron readout in the FS-220 to the output of the unlock detector. I also used this point to prevent the HT-220 relay from energizing. With these connections, the transmitter will

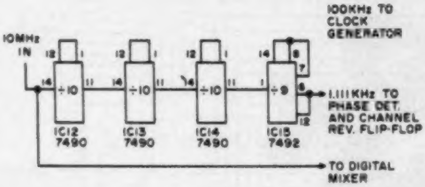

10MHz IN
12
1
14
÷10
11
IC12
7490
IC13
7490
IC14
7490
÷9
8
7
12
IC15
7492
100KHz TO CLOCK GENERATOR
1.111KHz TO PHASE DET. AND CHANNEL REV. FLIP-FLOP
TO DIGITAL MIXER

Fig. 2. Reference divider chain. Pins 2, 3, 6, 7, and 10 of IC12-IC14 are grounded. Pin 10 of IC15 is grounded. All IC's have pin 5 connected to 5 Volts.

not key and the digital display is blanked should an unlock condition be detected.

Voltage-Controlled Oscillator

The VCO consists of a Motorola MC1648P, using the essential ideas from K2OAW's article. Some changes were desirable. The varactor diode used at D1 was from a five-pack found at Radio Shack. A variable capacitor is used at C1. When the control line on the base of Q1 goes high (+3 to +5V) C1 is connected across the tank circuit, causing the VCO to tune the 14.000 – 14.443 MHz range. With the control line low, the VCO tunes 16.000 – 16.663 MHz. C1 was adjusted to provide about the same control voltage from the phase detector when working simplex on 146.52 MHz. The tuning range is actually a bit wider than required to insure that the VCO remains in lock at all times.

The dc control voltage must be extremely free from noise to prevent frequency modulation of the VCO. With all of the TTL logic in this rig, a great deal of care was necessary to keep the noise down. I found that a good part of the background noise on the VCO was entering through the switching transistor via the control line. Filtering this line greatly reduced background hiss and assorted weird grumblings.

The output of the VCO drives both the digital mixer and a switched buffer amplifier between the VCO and the frequency multipliers.

Programmable Divider

The techniques employed in this divider have been well published in the amateur magazines within the last year or so. The number N by which the counters are to divide is presented in BCD format to the individual 74192 programmable up-down counters. There is no fancy footwork required to shift to the receiver i-f frequency since in my HT-220 the i-f was an even megahertz. Circuitry must be provided to take care of the propagation delay in the ICs, however. K2OAW gave a good account of the techniques used for ÷N counters.

During receive conditions, the T/R logic sets pin 1 of IC 19 to +5V and grounds pin 10. This presets IC 19 to divide by three.

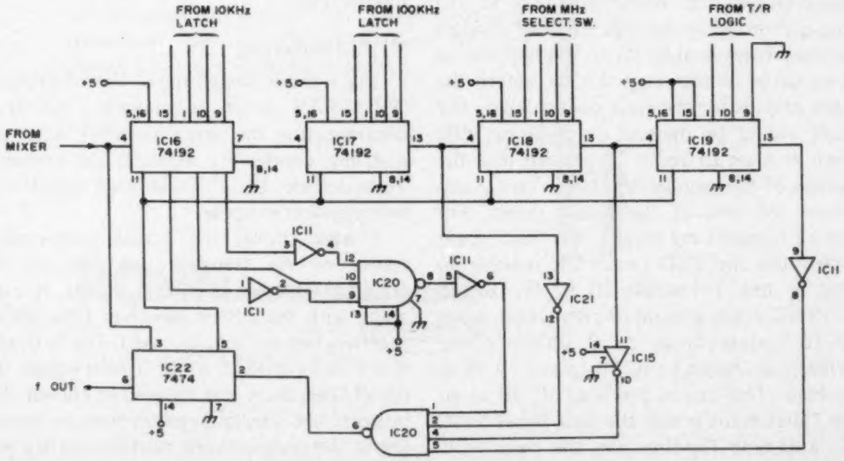

FROM 10KHz LATCH
FROM 100KHz LATCH
FROM MHz SELECT. SW.
FROM T/R LOGIC
+5
5,16
15
1
10
9
FROM MIXER
4
IC16
74192
7
8,14
11
IC17
74192
13
IC18
74192
IC19
74192
IC11
IC20
IC21
IC15
IC22
7474
f OUT
3
5
6
2
14
7

Fig. 3. Programmable Divider Chain (÷N). IC15, IC20, IC21, and IC22 initiate reloading 2 counts from 0000 to overcome propagation delay.

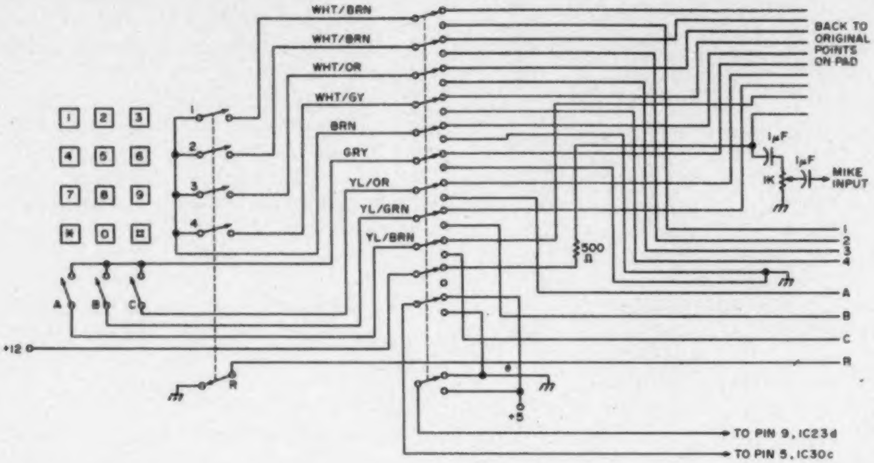


Fig. 4. Wiring of the Program-Operate switch which connects TT-pad switches to either the BCD encoder or the pad.

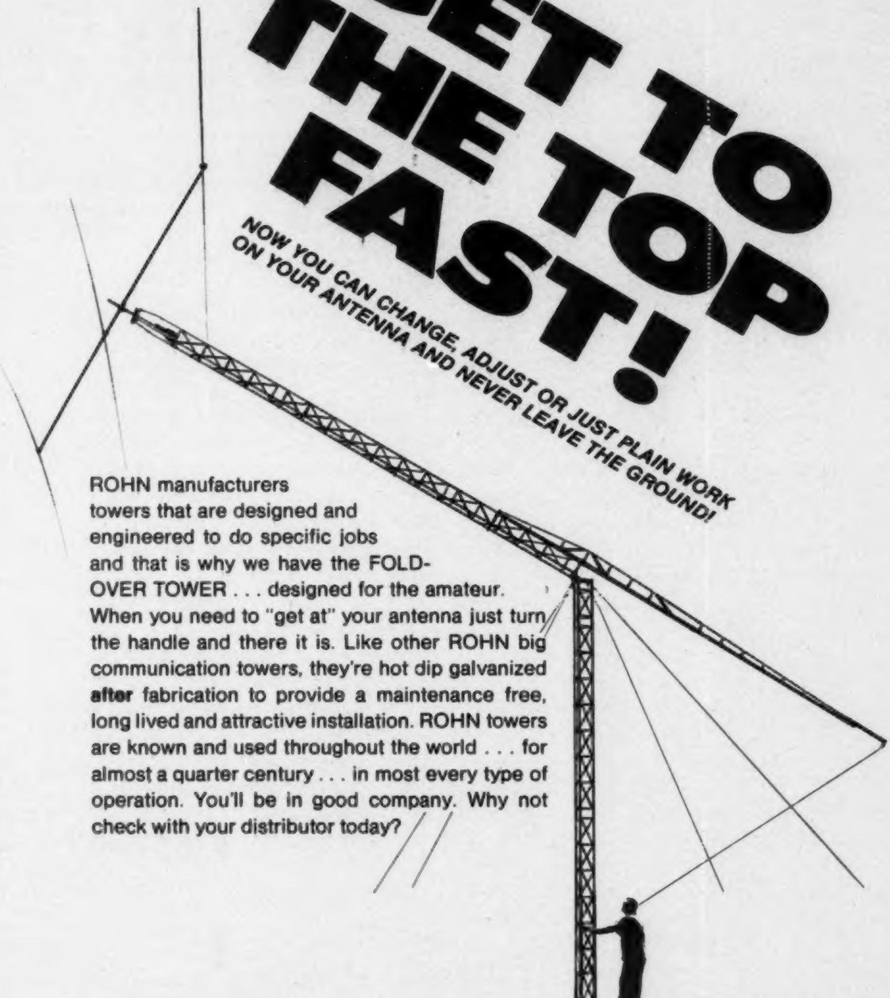
The MHz switch sets IC 18 to the proper divide number. In the 146 MHz portion of 2m, pins 15, 1, and 10 are grounded and pin 9 is at +5V, giving a preset count of 8. The remaining parts of the number N are set into IC 16 and IC 17 by either the memory or the scanner. In transmit, pin 1 of IC 19 goes low and pin 10 goes high presetting IC 19 to 5. The CHANNEL A MHZ switch then sets IC 18 to the desired megahertz.

If the VCO input to the divider chain was low enough in frequency no other circuitry would be required. Above 4 MHz or so, the propagation delay through the four dividers becomes considerable. When this happens an extra cycle or two may slip by before the chain reloads for the next count down. The result would be division by 3601 or 3602 when N is set to 3600. To prevent this, the loading of the number N is begun two cycles before the end of the count down. For 146.22 transmit the proper N is 5622. Each cycle from the VCO causes the number to drop by one. Eventually IC 17, IC 18, and IC 19 will reach a count of zero. Then, when IC 16 counts down to 2 (0002 in the divider), all inputs to IC 20 (pins 1, 2, 4, 5) are high. This causes pin 6 of IC 20 to go low. That point is also the data input to IC 22, a D-type flip-flop. On the next VCO cycle, pin 5 of IC 22 goes low, grounding the LOAD inputs of all 74192 dividers (pin 11). This forces the original count (5622) in to the divider chain. At the same time that pin 5 of IC 22 goes low pin 6 of the flip-flop goes high. On the next VCO cycle IC 22 sets (pin 5 high, pin 6 low). The output of the divider (IC 22, pin 6) therefore goes high for one half cycle of the VCO frequency once every 5622 counts (or N counts). This output is difficult to see unless you have an oscilloscope with at least a 10 MHz response since its width is typically 125 nanoseconds or so and it occurs only once in about a millisecond.

TT Pad Switching

Fig. 4 shows the wiring of the OPERATE--PROGRAM switch. It is largely a matter of disconnecting the seven switches from the pad and connecting them to the encoder. Tone decoder ICs could be used here but at much greater expense.

I have shown the actual color-coding found on my standard pad. One of the auxiliary switches, normally closed, is used along with the button switches. Only six of the switches are actually used. The *, 0, and # are not encoded. Since a zero equals 0V on all lines, there was no need to encode this button. The special symbols have no meaning in the programming routine and are not used. They all will store in memory as 0. I have labelled the switches on the pad for



GET TO THE TOP FAST!

NOW YOU CAN CHANGE, ADJUST OR JUST PLAIN WORK ON YOUR ANTENNA AND NEVER LEAVE THE GROUND!

ROHN manufacturers towers that are designed and engineered to do specific jobs and that is why we have the FOLD-OVER TOWER . . . designed for the amateur. When you need to "get at" your antenna just turn the handle and there it is. Like other ROHN big communication towers, they're hot dip galvanized **after** fabrication to provide a maintenance free, long lived and attractive installation. ROHN towers are known and used throughout the world . . . for almost a quarter century . . . in most every type of operation. You'll be in good company. Why not check with your distributor today?

ROHN® MANUFACTURING
DIVISION OF UNARCO
P.O. Box 2000 / Peoria, Ill. 61601

ease in identification. The column switches are labelled A, B and C. The row switches are labelled 1, 2, 3 and 4. For example, pushing a 1 causes switches A and 1 to close (and opens the auxiliary switch). The auxiliary switch is labelled R because it is used to reset the bounceless pushbutton flip-flops.

The switch used to connect the pad to the BCD encoder was a multiple-wafer 12 PDT rotary switch. Contacts are provided for applying +12V to the pad for normal operation. The transmitter is also disabled by the switch during programming operations. Audio from the pad is applied in parallel with the mike through the attenuator network shown.

BCD Encoder

The awesome looking layout in Fig. 5 is the BCD encoder. I have shown the TT pad wired directly to the encoder for simplicity and clarity. IC 1 – IC 3 are used as bounceless pushbuttons to eliminate false data caused by the mechanical bouncing of the pad switches. IC 4 through IC 10 detect which two switches on the pad are closed and set the proper BCD output lines low. The output lines are inverted. That is, when a 2 is pushed the BCD equivalent in 0010. The output of the encoder is not 0010, but 1101. This is indicated by the bars over the symbols. Another inversion takes place in the system before the number gets stored.

Note that there are also outputs from the A, B and C switch encoders. These lines are also inverted. For every button pushed, one of these three lines must go low. This flag is used to tell the clock generator that a TT pad button has been pushed; the BCD outputs tell the memory which button it was.

Clock Generator

The clock generator, shown in Fig. 6, is one of the more interesting circuits. It provides any preset number of pulses as desired.

The clock generator is started when one of the TT pad buttons is pushed while in the PROGRAM mode. The A, B and C inverted outputs from the BCD encoder go to IC 25a. When any one of them drops low, pin 6 of IC 25a goes high and remains high so long as the button is depressed. On the high to low

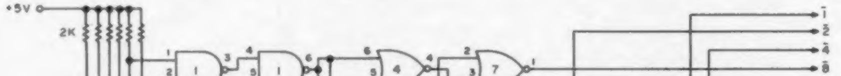


Fig. 5. BCD Encoder. IC numbers are shown on each logic element. The bars over the numbers and letters indicate inverted logic states. The Operate-Program switch is not shown here.

MICROPHONE
ANTENNA
POWER 12V

Rear view showing the connectors for power, antenna and microphone. The two LM309 regulators were mounted after scraping away enough paint to get good thermal contact with the chassis.

transition, a one-shot multivibrator IC 33 triggers for 25 milliseconds, storing the number in a quad latch, IC 34. At the same time, one-shot multivibrator IC 35 triggers for 150-200 milliseconds. Its output goes high for that length of time. At the end of the 150 ms pin 6 of IC 35 goes low. One of the places this signal goes is to another data selector made up of IC 30c, IC 29b, c and d. In the PROGRAM mode, this selector connects the output of IC 35 to the MODE inputs of the 7495 shift registers in the memory. When IC 35 goes high, then low, it selects right shift (parallel input) in the 7495 ICs. In the operate mode, the selector connects the MODE line to the output of IC 32a which determines left or right shifts as explained later. The output of IC 35 also goes to a second data selector consisting of IC 14b, c and d. In the PROGRAM mode this selector causes the P/S converter to load the BCD number from IC 34 as IC 35 makes its high to low transition. Later in the sequence the selector connects the P/S converter to the clock generator (which shifts the BCD number into the first memory slot. In the operate mode this data selector connects the P/S converter mode control directly to the clock generator.

So far all of the control lines have been explained, but nothing has been said about the clock generator itself. The output of IC 35 is also connected to inverter IC 26a. Its output is differentiated by an RC network, producing first a negative pulse and then a positive pulse. On the input of the positive pulse pin 4 of IC 23b goes low for the duration of the pulse. The negative transition of IC 23b causes the clock control flip-flop IC 24a to preset (Q output pin 15 goes high and remains high). This initiates (at long last) the clock generator sequence. Flip-flop IC 24b along with IC 31a make up a "ones-detector." This part of the circuit was found in "Designing with TTL Inte-

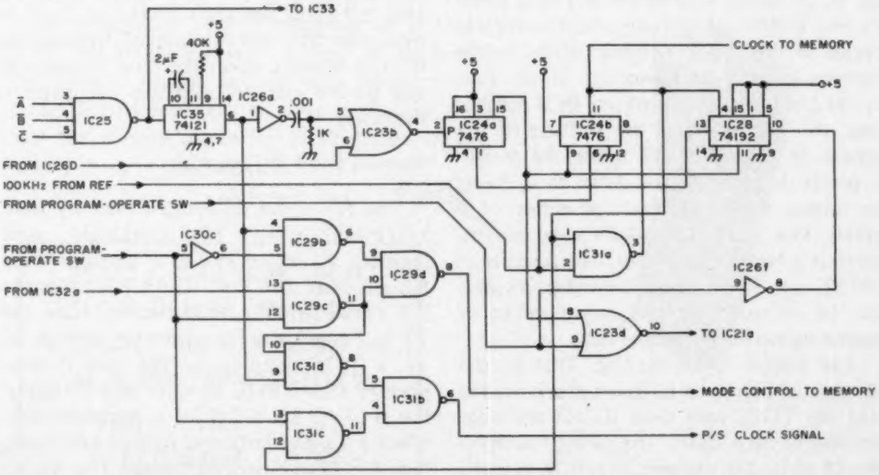

TO IC33
+5
40K
2µF
IC25
IC35
74121
IC26a
.001
1K
IC23b
$\bar{A}$
$\bar{B}$
$\bar{C}$
+5
IC24a
7476
P
+5
IC24b
7476
CLOCK TO MEMORY
+5
IC28
74192
FROM IC26D
100KHz FROM REF
FROM PROGRAM-OPERATE SW
IC30c
FROM PROGRAM-OPERATE SW
FROM IC32a
IC29b
IC29c
IC29d
IC31a
IC26f
IC23d
TO IC21a
IC31d
IC31b
MODE CONTROL TO MEMORY
IC31c
P/S CLOCK SIGNAL

Fig. 6. Clock Generator. This circuit produces pulses for shifting the memory and inhibiting the transmitter during programming.

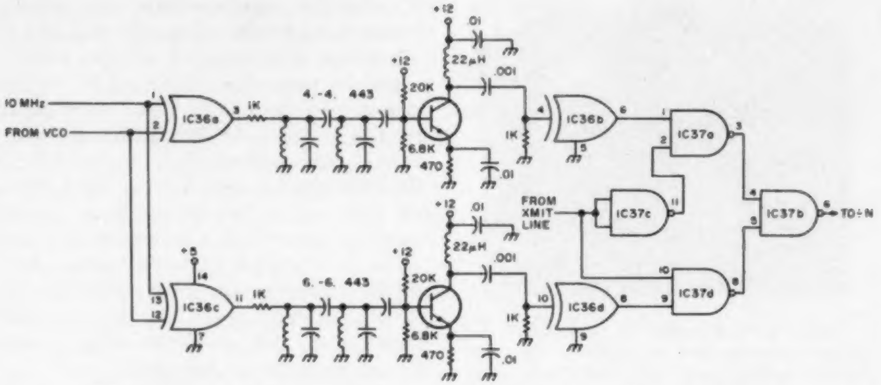


Fig. 7. Digital Mixer. A separate mixer and filter is provided for transmit and receive. IC37 is a switch to select the proper mixer output.

grated Circuits," one of Texas Instruments Electronics Series. A 100 kHz square wave feeds the clock input of IC 24b. This signal will appear at pin 11 of IC 24b so long as the J input, pin 9, is high. This arrangement allows integral numbers of cycles to pass through the "ones-detector." The output of IC 24b, pin 11, goes to the memory as the shift clock signal. It also feeds a programmable divider, IC 28. In the PROGRAM mode, this divider is preset to count from 3 down to 0. When it hits 0, the borrow output (pin 13) goes low, clearing the control flip flop IC 24a. That in turn shuts off IC 24. Since IC 24b will not shut down in the middle of a cycle, four complete cycles of the 100 kHz signal go out to the memory and P/S converter. Those four cycles cause the loading of one BCD number into the memory and the shifting of the others. In the OPERATE mode, the divider is preset to count from 7 down to 0, giving an output from the clock generator of 8 pulses. This particular circuit can be used by itself as a N-pulse generator. The number of 74192 (or 74193) programmable dividers can be increased to give any number of output pulses on a one-time basis.

The circuit is self-loading. That is, the number of pulses to be generated is loaded into the 74192 each time IC 24a resets (at the end of each shift). The gating line from pin 15 of IC 24a also goes to a NOR gate, IC 23d. Pin 10 of IC 23d goes low whenever the clock generator is causing a memory shift. This low signal is used in inhibit the transmitter.

Digital Mixer

The VCO output frequency is just a little too high for reliable counting in my programmable divider, so I used a heterodyning method to lower the input frequency to the 74192 chain. As shown in Fig. 7, the mixer itself consists of a 7486 exclusive OR gate, IC 36. The output of the exclusive OR with two signals on the input includes the sum and difference frequencies, plus many harmonics. To prevent confusion of the ÷N, separate mixers were used for transmitting and receiving. Bandpass filters are used to pass only the desired range of frequencies, IC 37a, b and c select the filter output. Q2 and Q3 are used to overcome the losses in the filters.

Memory and P/S Converter

The P/S converter and the memory were assembled using 7495 left/right shift registers. As shown in Fig. 8, seven of these ICs are used. The first, IC 38, is used as the P/S converter. The BCD number from the TT pad enters the P/S converter through IC 34, a 7475 quad latch. The data is temporarily stored in IC 34 when IC 33 triggers. Pin 6 of IC 33, a 74121, is normally low. When a TT pad button is pushed pin 6 goes high for 25 milliseconds or so. This causes the data to enter IC 34. When pin 6 goes low again the latch holds the data that was

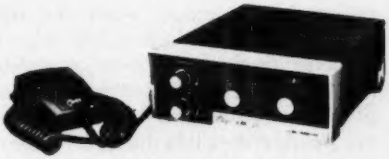
Clegg HOLIDAY SPECIALS

FIRST. The 2 meter leader . . . the Clegg FM-27B. The only transceiver that covers the entire range of 146-148 MHz . . . and needs no additional crystals. The reliable rig that costs you a lot less in the long run. Get one and be a leader.

Amateur Net . . . ~~$479.95~~

SECOND. The world of 220. . . away from the 2 meter crowd with the Clegg FM-21. This transceiver has a unique triple-duty crystal feature. . . it uses just one crystal in any channel. The specs are tough to beat. . . so is the price. . . extend your range! Join the world of 220.

Amateur Net of FM-21 . . . ~~$319.95~~



AND NOW . . . the Clegg HT-146. Wait 'til you get your hands on this all-new hand-held 2-meter transceiver. Designed to give you reliable commercial quality performance at low cost. All solid-state with a host of features including a unique battery saver design. See your Clegg Dealer, call or write us now, or fill out the coupon below for detailed data sheet on what we're handing you.

Amateur Net . . . ~~$288.95~~

HURRY. . . .TO YOUR LOCAL CLEGG DEALER TODAY FOR SPECIAL HOLIDAY PRICES AT SUPER SAVINGS VALUES.

FOR. . . . A

HAPPY HOLIDAY

ISC—Clegg DIVISION

3050 Hempland Rd. • Lancaster, Pa. 17601
Tel: (717) 299-3671 • Telex 84-8438

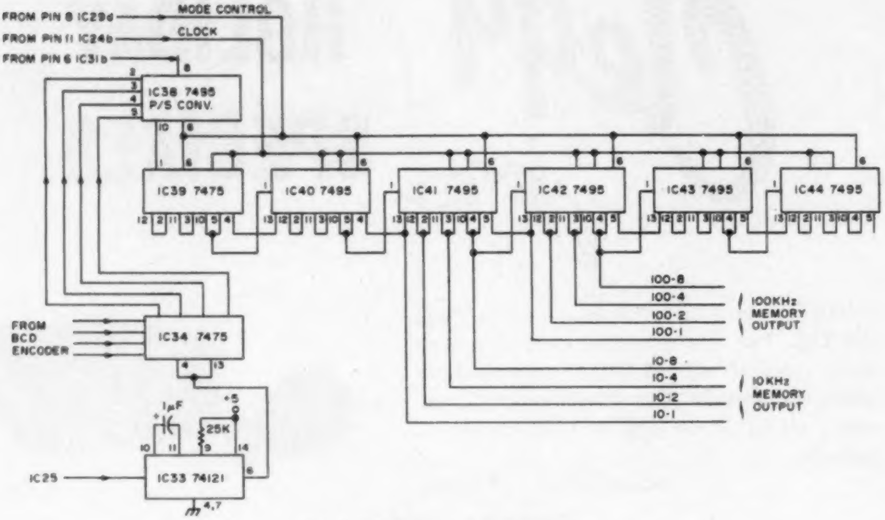

FROM PIN 8 IC29d
MODE CONTROL
FROM PIN 11 IC24b
CLOCK
FROM PIN 6 IC31b
IC38 7495
P/S CONV.
IC39 7475
IC40 7495
IC41 7495
IC42 7495
IC43 7495
IC44 7495
100-8
100-4
100-2
100-1
100KHz
MEMORY
OUTPUT
10-8
10-4
10-2
10-1
10KHz
MEMORY
OUTPUT
FROM
BCD
ENCODER
IC34 7475
1µF
+5
25K
IC25
IC33 74121
4,7

Fig. 8. P/S Converter and memory.

present at its inputs when the negative transition occurred. The output from IC 34 is taken from the $\bar{Q}$ pins, providing the inversion necessary to give true BCD coding of the decimal number into the memory. At this point in the chain the BCD numbers will have the coding found in Table 1 (Oct. 1974).

The data enters the P/S converter at the parallel inputs. The 7495 can be used for several functions. When pin 6 is high (Mode control), parallel-in, parallel-out operations may be performed. The data present at pins 2, 3, 4 and 5 are transferred to the outputs (pins 13, 12, 11 and 10) on each pulse of the CLOCK 2 input (pin 8). Shift left can be implemented in this mode by connecting

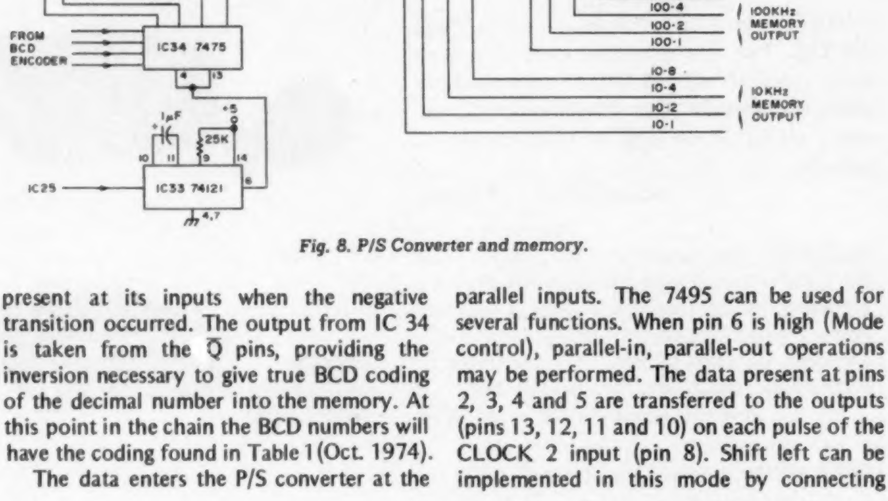
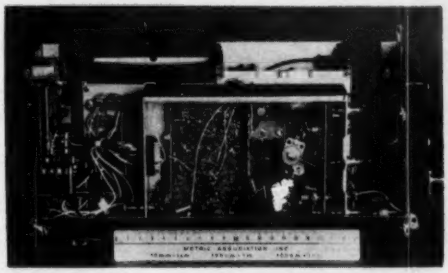

FROM SQUELCH
TO IC55 (FIG 10)
FROM PIN 4 IC41
IC47
IC48
IC50
7475
10-8
10-4
10-2
10-1
LATCH OUTPUT TO ÷N (FIG.3)
FROM PIN 3 IC41
IC49
TO IC51
(FIG. 10)
FROM PIN 2 IC41
IC46
7476
2,3,6,7
FROM PIN 13 IC41
FROM SCAN SW.
FROM SCAN SW.
IC47c
IC47a
IC48c
+5
2.7K
1K
IC45
35µF
2.7K
1K
35µF

Fig. 9. 10 kHz Latch. IC47, IC48, and IC49 for a data selector to connect either the memory or the scanner to the ÷N.

each output to the parallel-input of the preceeding flip flop (pin 10 to pin 4, pin 11 to pin 3, etc.). Serial data would be entered at pin 5. Shift-right operations are performed with the mode control pin 6 low. With each CLOCK 1 pulse data is transferred from one flip flop to the next flip flop down the line. Serial data is entered at pin 1 in this mode. IC 38 is used for parallel-in, shift-right operations only (parallel in to serial out). It accepts the data from the quad latch in parallel format, then shifts right on each of the four pulses from the clock generator. This moves one BCD number serially into IC 39, the first memory slot. IC 39 through IC 44 are wired for both left and right shifting operations. In the PROGRAM mode pin 6 of these six ICs is held low during the four clock generator pulses. The serial data from the P/S converter is loaded into each slot. In the OPERATE mode the mode control pin 6 changes depending upon the position of the CHAN REV switch. Normally, it is low for shifting right into the transmit frequency, and high for shifting left into the receive frequency. An exception to this is in SIMPLEX mode. Once set for either A or B channel simplex operation, the mode control signal is inhibited (does not change).



This side view clearly shows the HT-220 circuit board with the buffer/multipliers to the right. All circuit boards and other critical circuitry were mounted in shielded boxes.

The output from memory is taken from the parallel outputs of IC 41 and IC 42. It should be obvious that with this shift register form of storage extra slots are necessary to save the data not currently being read out. That is the reason for 24 bits of storage with only 16 bits of data.

Scanner

The scanning circuitry is identified by two labels — the 10 kHz latch and the 100 kHz latch. The two parts are very much the same. The 10 kHz latch is shown in Fig. 9. Three sections of a hex inverter, IC 45, are used as an oscillator with constants fixed for a frequency of roughly 10 Hz. This oscillator

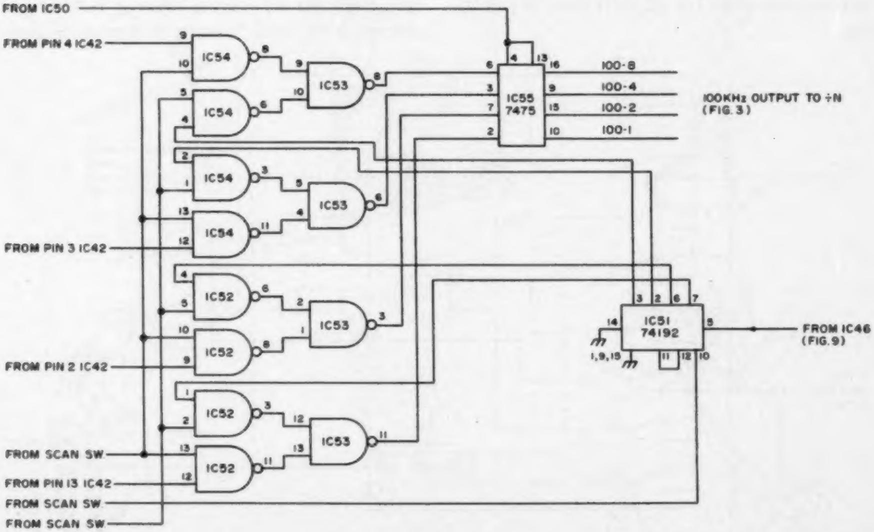

FROM IC50
FROM PIN 4 IC42
FROM PIN 3 IC42
FROM PIN 2 IC42
FROM SCAN SW
FROM PIN 13 IC42
FROM SCAN SW
FROM SCAN SW
IC54
IC54
IC54
IC54
IC52
IC52
IC52
IC52
IC53
IC53
IC53
IC53
IC55
7475
100-8
100-4
100-2
100-1
100KHz OUTPUT TO ÷N
(FIG. 3)
IC51
74192
1,9,15
FROM IC46
(FIG. 9)

Fig. 10. 100 kHz Latch. Circuitry is the same as the 10 kHz latch with the exception of IC51.

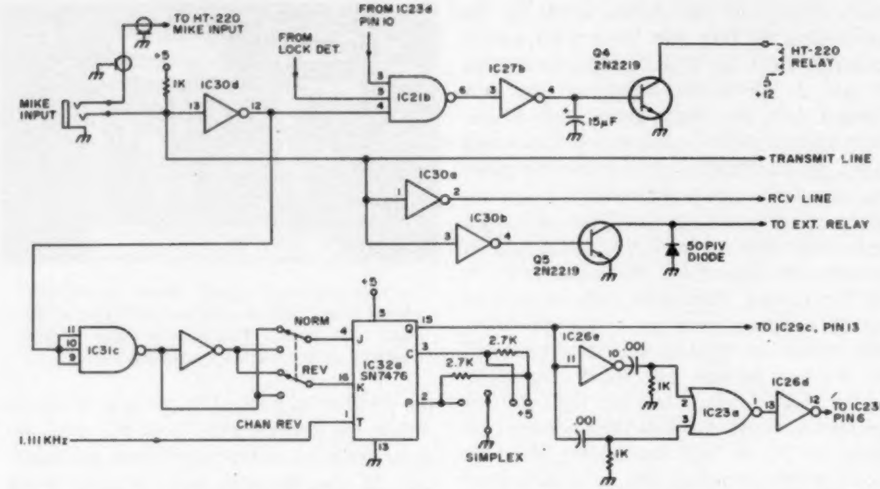

TO HT-220 MIKE INPUT
FROM IC23d PIN 10
FROM LOCK DET
Q4 2N2219
HT-220 RELAY
+12
+5
1K
IC30d
MIKE INPUT
IC21b
IC27b
15μF
TRANSMIT LINE
IC30a
RCV LINE
IC30b
TO EXT. RELAY
50PIV DIODE
Q5 2N2219
NORM
REV
IC31c
IC32a SN7476
2.7K
2.7K
TO IC29c, PIN 13
IC26a
.001
1K
IC23a
IC26d
TO IC23b PIN 6
CHAN REV
1.111 KHz
SIMPLEX

Fig. 11. T/R Logic. Transmitter keying, channel reversing, simplex, and memory control are controlled with this circuitry.

drives IC 46, a 7490. IC 46 and its companion IC 51 (74192) constitute a ÷100 or ÷50 chain. IC 46 is wired for BCD counting. Its outputs follow exactly the sequence found in Table I and are used in place of the memory outputs for scanning in 10 kHz steps. IC 47, IC 48, and IC 49 form another data selector. The operation of only one section will be described since the concept remains the same for all such selectors in this rig.

The 10-1 line (BCD 1 portion of the 10 kHz section) is switched by IC 47a, IC 47c, and IC 48c. When the SCAN switch is set to OFF pin 13 of IC 47c is high and pin 2 of IC 47a is low. Since IC 47 is a quad NAND gate pin 3 will remain high regardless of the state of pin 1 (because pin 3 is low). Pin 11 of IC 47c will be low when pin 12 is high and vice versa. The total action just described can be summed up by saying that a NAND gate becomes a simple inverter if one of its inputs

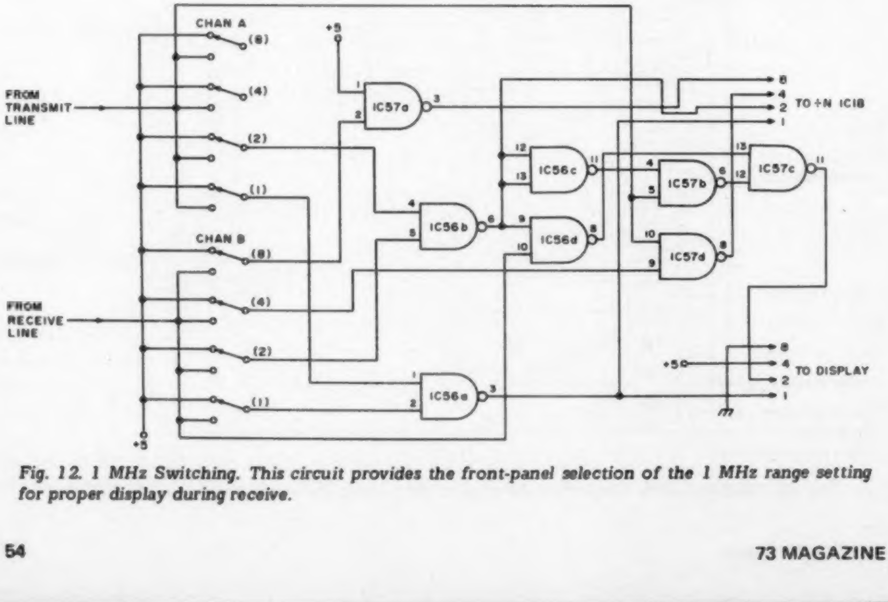
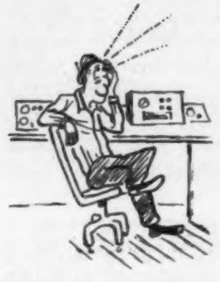
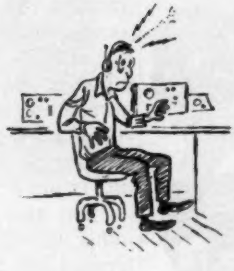

CHAN A
(8)
(4)
(2)
(1)
FROM TRANSMIT LINE
+5
IC57a
IC56c
IC57b
IC57c
IC56b
IC56d
IC57d
CHAN B
(8)
(4)
(2)
(1)
FROM RECEIVE LINE
IC56a
8
4
2
1
TO ÷N IC18
8
4
2
1
TO DISPLAY
+5

Fig. 12. 1 MHz Switching. This circuit provides the front-panel selection of the 1 MHz range setting for proper display during receive.

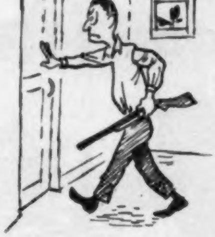
B. Rogers
1034 N. Fern
Escondido CA



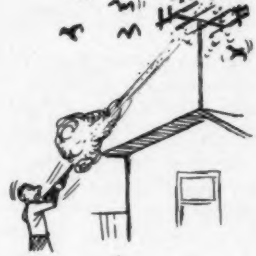
1



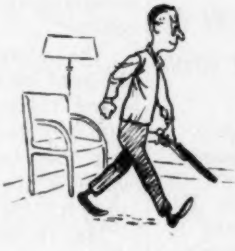
2



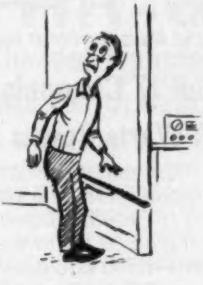
3



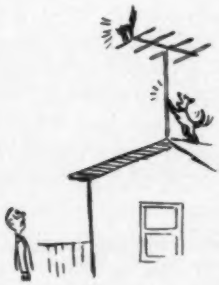
4



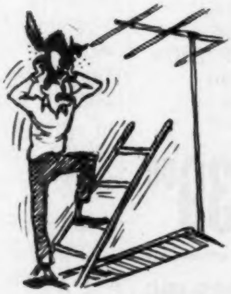
5



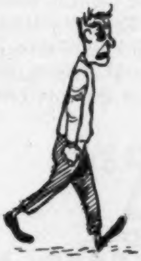
6



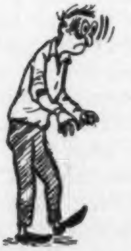
7



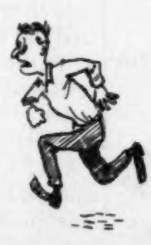
8



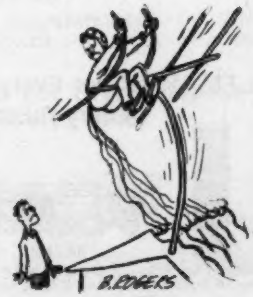
9



10



11



12

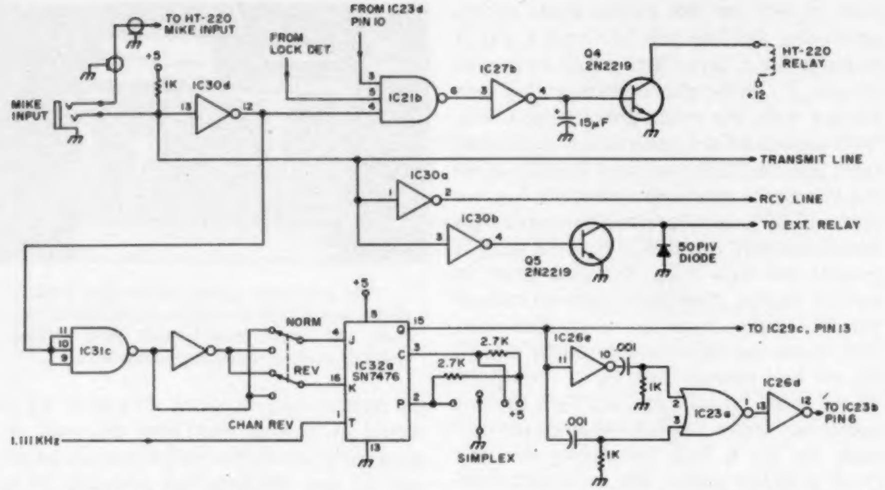

TO HT-220 MIKE INPUT
FROM IC23d PIN 10
FROM LOCK DET
Q4 2N2219
HT-220 RELAY
+12
+5
1K
IC30d
IC27b
IC21b
MIKE INPUT
15μF
TRANSMIT LINE
IC30a
RCV LINE
IC30b
TO EXT. RELAY
50PIV DIODE
Q5 2N2219
NORM
REV
IC32a SN7476
IC31c
2.7K
2.7K
TO IC29c, PIN 13
IC26e
.001
1K
IC23a
IC26d
TO IC23b PIN 6
CHAN REV
1.111 KHz
SIMPLEX
.001
1K

Fig. 11. T/R Logic. Transmitter keying, channel reversing, simplex, and memory control are controlled with this circuitry.

drives IC 46, a 7490. IC 46 and its companion IC 51 (74192) constitute a ÷100 or ÷50 chain. IC 46 is wired for BCD counting. Its outputs follow exactly the sequence found in Table I and are used in place of the memory outputs for scanning in 10 kHz steps. IC 47, IC 48, and IC 49 form another data selector. The operation of only one section will be described since the concept remains the same for all such selectors in this rig.

The 10-1 line (BCD 1 portion of the 10 kHz section) is switched by IC 47a, IC 47c, and IC 48c. When the SCAN switch is set to OFF pin 13 of IC 47c is high and pin 2 of IC 47a is low. Since IC 47 is a quad NAND gate pin 3 will remain high regardless of the state of pin 1 (because pin 3 is low). Pin 11 of IC 47c will be low when pin 12 is high and vice versa. The total action just described can be summed up by saying that a NAND gate becomes a simple inverter if one of its inputs

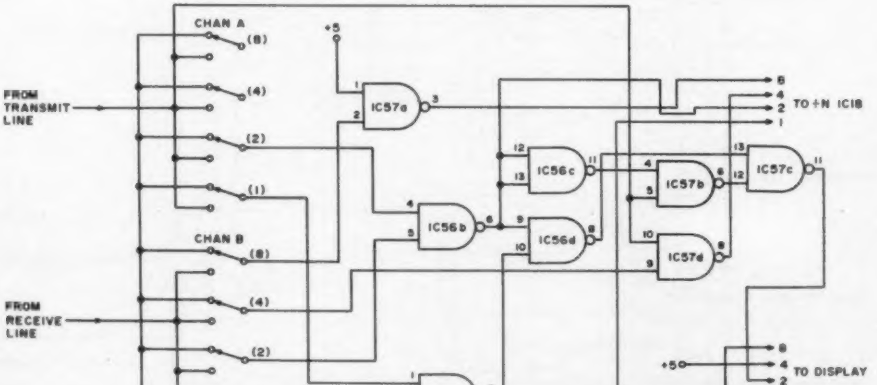
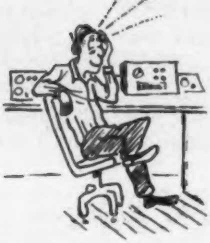
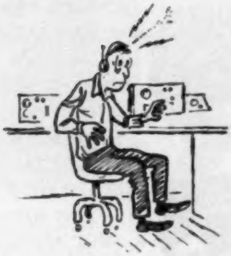

CHAN A
(8)
(4)
(2)
(1)
FROM TRANSMIT LINE
+5
IC57a
IC56c
IC57b
IC57c
IC56b
IC56d
IC57d
CHAN B
(8)
(4)
(2)
(1)
FROM RECEIVE LINE
IC56a
+5
8
4
2
1
TO ÷N IC18
+5
8
4
2
1
TO DISPLAY

Fig. 12. 1 MHz Switching. This circuit provides the front-panel selection of the 1 MHz range setting for proper display during receive.

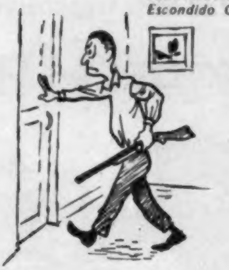
B. Rogers
1034 N. Fern
Escondido CA



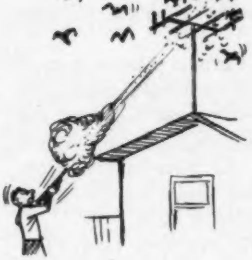
1



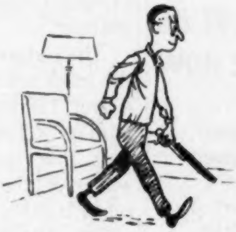
2



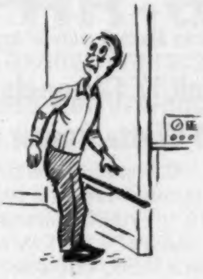
3



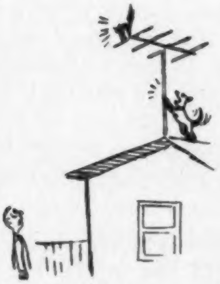
4



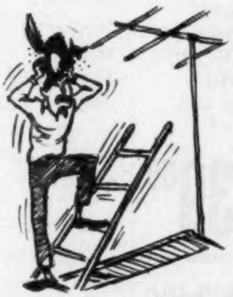
5



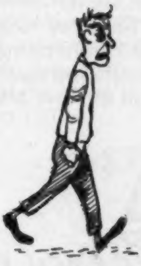
6



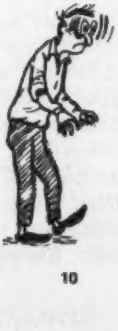
7



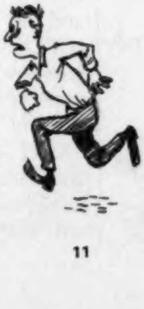
8



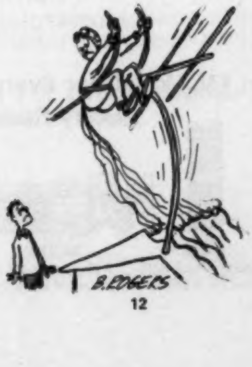
9



10



11



12

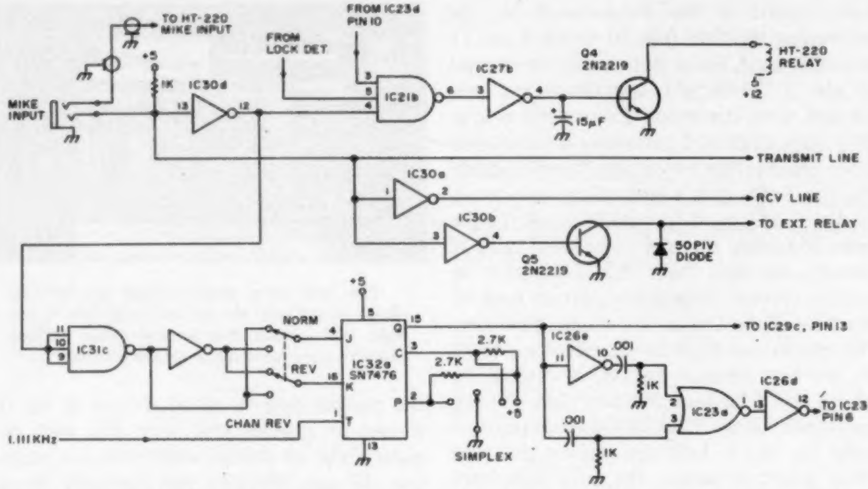

TO HT-220 MIKE INPUT
FROM IC23d PIN 10
FROM LOCK DET
Q4 2N2219
HT-220 RELAY
+12
+5
1K
IC30d
IC21b
IC27b
MIKE INPUT
15μF
TRANSMIT LINE
IC30a
RCV LINE
IC30b
TO EXT. RELAY
50PIV DIODE
Q5 2N2219
NORM
REV
IC31c
IC32a SN7476
J
K
T
Q
C
P
CHAN REV
1.111KHz
2.7K
2.7K
SIMPLEX
TO IC29c, PIN 13
IC26a
.001
1K
IC23a
IC26d
TO IC23b PIN 6

Fig. 11. T/R Logic. Transmitter keying, channel reversing, simplex, and memory control are controlled with this circuitry.

drives IC 46, a 7490. IC 46 and its companion IC 51 (74192) constitute a ÷100 or ÷50 chain. IC 46 is wired for BCD counting. Its outputs follow exactly the sequence found in Table I and are used in place of the memory outputs for scanning in 10 kHz steps. IC 47, IC 48, and IC 49 form another data selector. The operation of only one section will be described since the concept remains the same for all such selectors in this rig.

The 10-1 line (BCD 1 portion of the 10 kHz section) is switched by IC 47a, IC 47c, and IC 48c. When the SCAN switch is set to OFF pin 13 of IC 47c is high and pin 2 of IC 47a is low. Since IC 47 is a quad NAND gate pin 3 will remain high regardless of the state of pin 1 (because pin 3 is low). Pin 11 of IC 47c will be low when pin 12 is high and vice versa. The total action just described can be summed up by saying that a NAND gate becomes a simple inverter if one of its inputs

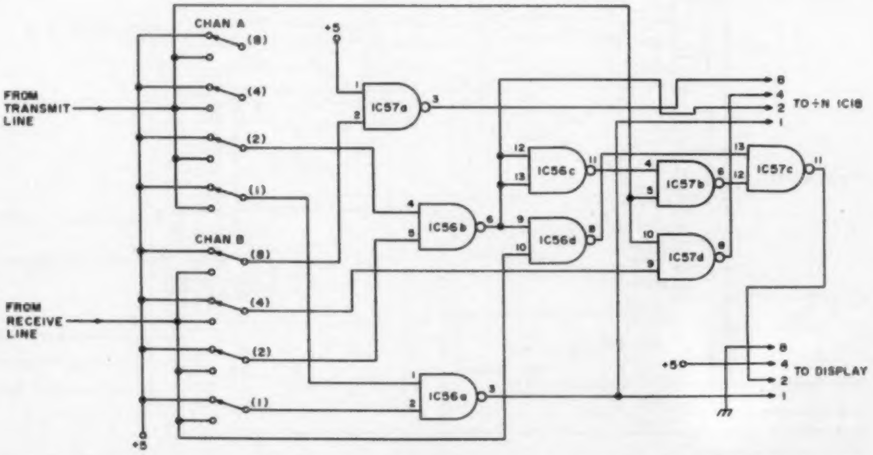
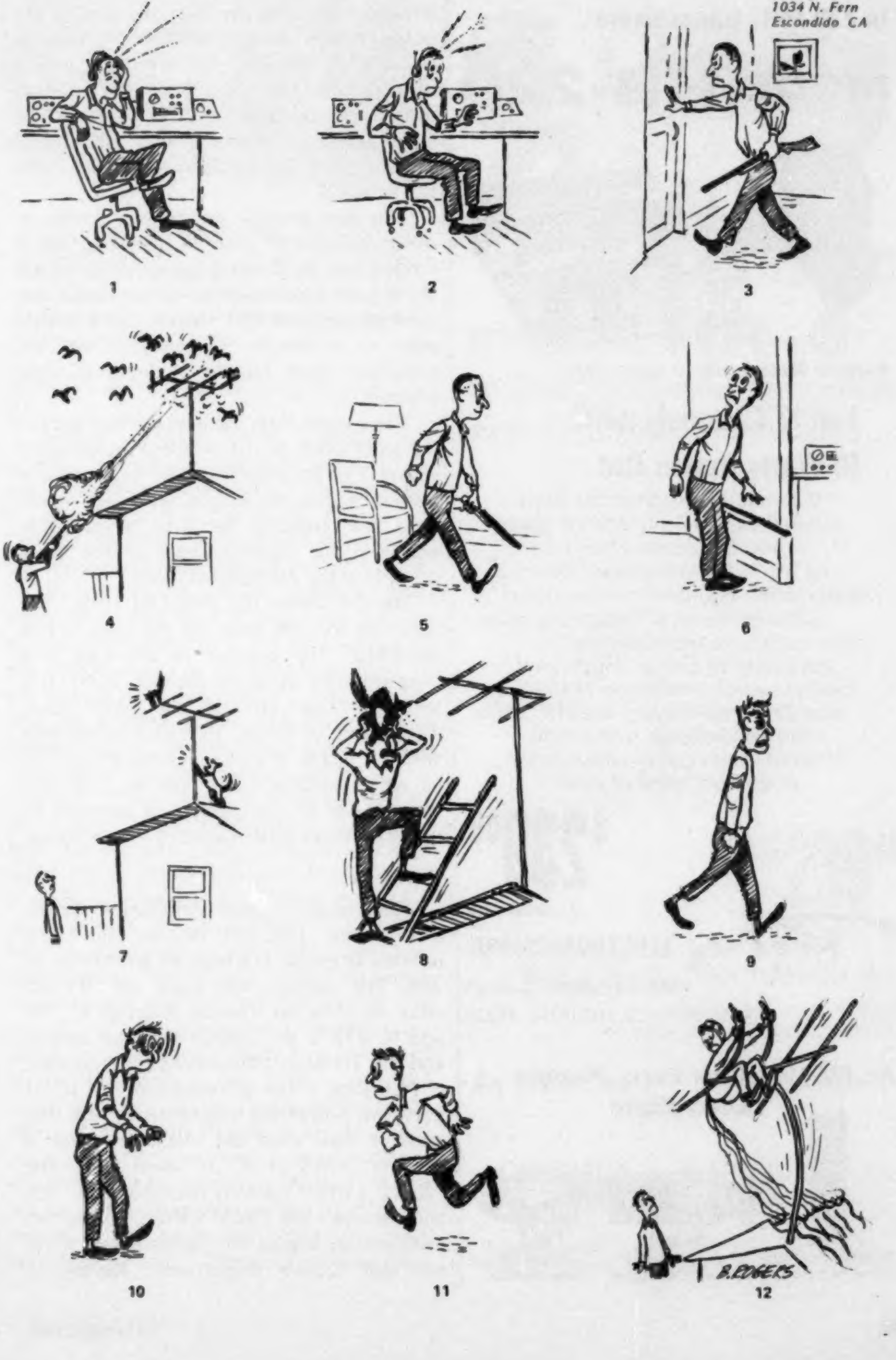

CHAN A
(8)
(4)
(2)
(1)
+5
FROM TRANSMIT LINE
IC57a
IC56b
IC56c
IC56d
IC57b
IC57c
IC57d
TO ÷N IC18
8
4
2
1
CHAN B
FROM RECEIVE LINE
IC56a
TO DISPLAY

Fig. 12. 1 MHz Switching. This circuit provides the front-panel selection of the 1 MHz range setting for proper display during receive.

B. Rogers
1034 N. Fern
Escondido CA


1
2
3
4
5
6
7
8
9
10
11
B.ROGERS
12

Regency brings you the best in 220 MHz transceivers

MODEL HR-220

American Made Quality at Import Price

Full 12 Channels with 10 Watts Power Out

Compactly designed for dash mount, this little transceiver gives you big signal power on the go . . . at low current drain. 3 watts audio equipped with a noise operated squelch system provides clear reception and excellent sensitivity of 0.4 μv. High-Low power switch. American Made and Regency reliable, the HR-220's solid state design brings you tough, top quality circuitry at the low price of only

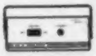
$239.00 Amateur Net

Regency ELECTRONICS, INC.
7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

An FM Model For Every Purpose . . . Every Purse

HRT-2
5 Channel Hand-Held
2 Meter FM Transceiver

HR-2MS
8 Channel Transcan
2 Meter FM Transceiver



AR-2
2 Meter FM
Power Amplifier

is held high, and becomes inactive if either of its inputs is held low. IC 48c acts as an inverter all the time. Pin 12 of IC 48c remains high with the scan off, causing the output of the selector to follow the input at pin 12 of IC 47c. No inversion occurs through the selector. When the scan is turned on the output of the selector at pin 11 of IC 48c follows the input of IC 47a. That input is the 10-1 line from the 7490 BCD counter.

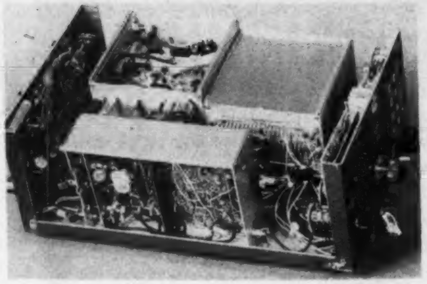
This data selector can be very handy in other applications since its switching time is limited only by the propagation delay within the ICs (in nanoseconds). The particular one used here is an 8 PDT switch. Using NAND gates to synthesize the selector was less expensive than buying a single IC data selector.

The output from the data selector goes to the quad latch, IC 50. Its clock inputs (pins 4 and 13) are normally held high and the outputs follow the inputs. The clock inputs drop low, freezing the data in the latch, whenever the squelch opens or the transceiver is in the PROGRAM mode.

Fig. 10 shows the 100 kHz latch. The data selector and latch are the same as just described. The counter in this case is a programmable up down counter, IC 51. It is wired to count up from the preset input. The setting of the SCAN switch determines where it begins to count. It is preset to 0 for an entire megahertz scan and to 5 for just the top half of a megahertz. It increases by one with every tenth count of the oscillator.

T/R Logic

The transmit receive switching is reasonably simple. The PTT line in Fig. 11, is isolated from the T/R logic by an inverter IC 30d. The inverter will cause the HT-220 relay to close on transmit through IC 31b and IC 27b if the Unlock Detector output and the Transmit Inhibit lines are both high. If PLL lock is not achieved pin 5 of IC 31 goes low, preventing transmitter keying. The same is true when the clock generator is running (pin 3 of IC 31 drops low). The "XMIT LINE" signal is inverted in IC 30a and becomes the "RCV LINE." These two lines provide logical "0" signals during transmit and receive respectively. Keying an



Tne HT-220 board and the buffer/multipliers are mounted in the box in the foreground. The two other boxes house all other circuit boards. The open box at the upper right holds the reference oscillator, phase detector, VCO and digital mixer.

external relay is possible using IC 30b and Q5.

Memory shifting during transmit and receive and during channel reversing is accomplished primarily with a J-K flip flop, IC 32a. IC 31c is in the line to the J-K flip flop for no other reason except to put it to use. Power requirements are reduced just a bit by connecting unused inputs to used inputs or to +5V on TTL chips. The J-K flip flop is clocked by the 1.111 kHz output of the ÷9000 chain. In the NORM position of the CHAN REV switch the J input is high and the K input is low. This forces the Q output high on the next clock pulse. With Q high (pin 15) the memory is set for a shift-left. When the PTT button is pushed the J input goes low and the K input goes high. On the next clock pulse this J-K data input causes the Q output to drop low and stay there regardless of the clock input. The mode control to the memory is therefore low, commanding a shift-right operation. The negative transition of the Q output is differentiated and inverted in IC 26e, IC 23a and IC 26d. The output of IC 26d is a short pulse (positive going). Since it is connected to IC 23b (Fig. 6), this pulse causes the clock generator to start feeding pulses to the memory. When the PTT button is released, J goes high (K goes low), programming a shift-left in the memory. Because of the wiring of the differentiator and inverter any change in the mode line causes the clock generator to start. Therefore, the memory

The 6 Meter Radio With Power To Spare

American Made
Quality at Import Price

MODEL HR-6

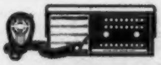
25 Watt, 12 Channel Transceiver With Solid State Performance

Here's the power to get you out on the 6 meter band without use of black box power hogs n your car trunk. Work repeaters or work skip on your choice of 12 channels, with independent switching for transmit and receive. That gives you 144 frequency combinations across the entire band . . . 52-54 MHz. This compact package delivers 0.35 μv sensitivity and 3 watts audio output for great listening. And the price is as compact as the radio . . .

only $239.00
Amateur Net

Regency ELECTRONICS, INC.
7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

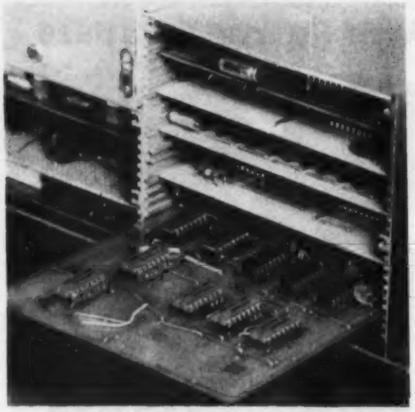
An FM Model For Every Purpose . . . Every Purse



HR-2MS
8 Channel Transcan
2 Meter FM Transceiver

HR-212
12 Channel-20 Watts
2 Meter FM Transceiver

AR-2
2 Meter FM
Power Amplifier



The individual circuit boards plug into sockets in the shielded enclosures. Trouble-shooting and circuit testing is simplified using a board extender. The board shown extended is the BCD Encoder board.

shifts left when the PTT switch is opened.

Channel reversing is simply a matter of convincing IC 32a that the PTT switch has been pushed when it hasn't. This is done by reversing the data into the J-K inputs. The contact bounce in the reversing switch causes many, many shifts to occur, but since each shift requires only 80 microseconds this is not noticeable. I have never observed a lost bit or incorrect shift due to this bouncing.

Simplex operation is obtained by holding IC 32a in either the set or preset condition. If the SIMPLEX switch is moved so that the Clear input (pin 3) is grounded, the Q output drops low and remains so until the Clear input is high once again. That is, it remains low regardless of the clock and J-K inputs. The Q output is set permanently to a 1 if the Preset input is grounded. In this way, the memory cannot shift when the PTT switch is closed and opened and simplex operation is achieved.

1 MHz Switching

The 1 MHz portion of the ÷N programming is selected by two panel mounted switches. Although ordinary rotary switches and a diode matrix may be used for this (thumb wheel, too), I was fortunate to find in surplus some rotary switches with BCD output. Each switch had four micro-switches ganged together and operated from a camming surface to give BCD encoding of the rotary motion. These are shown in the wiring diagram in Fig. 12. The CHANNEL A MHZ switch is selected during transmit and the CHANNEL B MHZ switch is used during receiving. This circuitry also subtracts 2 from the CHANNEL B MHZ switch setting. This is necessary since an 8 must be set on the switch to receive 146 MHz signals and it is desirable to display a 6, not the 8.

A computer-type circuit could have been used to subtract 2 from the receive setting. Full adders such as the 7483 could be used and were tried. I saved some circuitry and

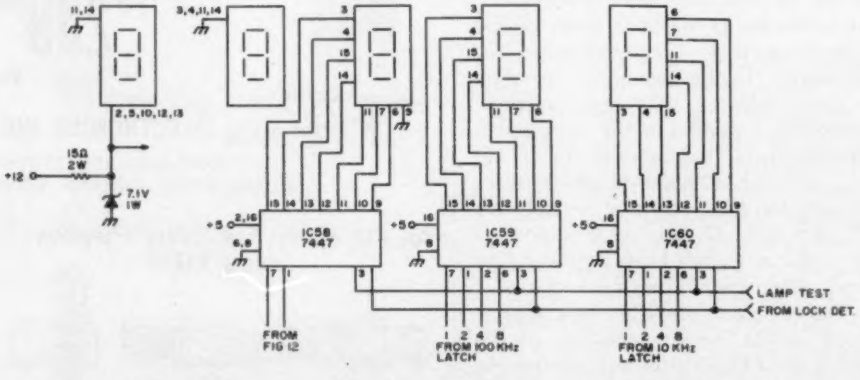


Fig. 13. Digital Display. All Minitrons have pins 2, 5, 10, 12, and 13 connected to 7 Vdc. Pin 9 is grounded on the center Minitron to provide a decimal point.

WEIRNU NOVEMBER SALE

Linear Price Schedule

300	Pos. V Reg. (Super 723)	T05	.80
301	Hi performance Ampl.	T05 or mini	.30
302	Voltage follower	T05	.80
304	Negative Regulator	T05	1.00
305	Voltage Regulator	T05	1.00
306	Voltage Comparator/Buffer	T05	4.00
307	Op Amp (Super 741)	T05 or mini	.30
308	Micro power op Amp.	T05	1.00
309H	5V Regulator (200 MA)	TO-5	1.75
309K	5V Regulator (1A)	TO-3	1.50
310	Voltage follower Op. Amp.	T05 or mini	1.00
311	Hi performance Voltage Comparator	T05 or mini	1.00
320 - 5.0V	Negative Regulator	T03	1.75
- 5.2V	Negative Regulator	T03	1.75
- 12V	Negative Regulator	T03	2.00
- 15V	Negative Regulator	T03	1.75
322	Precision Timer	DIP	2.25
324	Quad Op. Amp.	DIP	1.75
339	Quad Comparator	DIP	2.00
340K	Pos V Reg (+5,6,8,12,15,18,24 V)	TO-3	1.75
340T	Pos V Reg (+5,6,8,12,15,18,24 V)	TO-22	2.00
350	Dual Peripheral Driver	Dip	.80
351	Dual Peripheral Driver	Mini	.40
370	AGC/Squelch Amp.	DIP	1.00
371	Integrated RF/IF Amp.	T05	1.75
372	AF - IF strip - detector	DIP	.75
373	AM/FMI SSB strip	DIP	3.00
374	AM/FM/SSB IF Video Amplifier	Dip	2.75
376	Pos. Volt Regulator	Mini	.50
377	Dual 2W Power Amp	Dip	2.50
380	2 Watt Audio Amp.	DIP	1.50
380-8	.6W Audio Amp.	Mini	1.25
381	Low Noise Dual Pre Amp	DIP	1.75
382	Low Noise Stereo Pre Amp	DIP	1.75
550	Precision Voltage Regulator	DIP	1.50
555	Timer	Mini	1.00
565	Phase Lock Loop	T05 or Dip	2.50
566	Function Generator	Mini	2.50
567	Tone Decoder	Mini	2.50
703	RF – IF Amp.	T05	.40
709	Op Amp.	T05 or Dip	.30
710	Voltage Comparator	T05 or Dip	.30
711	Dual Diff. Comparator	T05 or Dip	.30
723	V Regulator	T05 or Dip	.60
725	Instrumentation Op Amp	Mini	2.25
733	Video Amp	Dip	1.25
741	Comp Op Amp.	T05, Mini, or Dip	.40
747	Dual 741 Op Amp.	T05 or Dip	.80
748	Freq. Adj. 741	Mini	.40
1303	Stereo Pre Amp.	Dip	.75
1304	FM Multiplex Stereo Demod.	Dip	1.00
1305	FM Multiplex Stereo Demod.	Dip	1.50
1307	FM Multiplex Stereo Demod.	Dip	.75
1310	Stereo Demodulator	Dip	2.50
1351	FM Detector/Limiter &Audio Preamp	Dip	1.00
1414	Dual Differential Comparator	Dip	.90
1436	High Voltage Op Amp	TO-5	3.95
1458	Dual Comp. Op Amp.	T05 or Mini	.70
2111	FM Detector & Limiter	Dip	.90
2113	FM Detector & Limiter	Dip	.90
3064	TV Automatic Fine Tuning Circuit	Dip	.75
3065	TV - FM Sound System	Dip	.60
3070	Chroma Subcarrier Regenerator	Dip	1.35
3071	Chroma IF Amplifier	Dip	1.35
3072	Chroma Demodulator	Dip	1.35
3075	FM Detector - LMTR and Audio Pre Amp.	DIP	.70
3900	Quad Amp.	DIP	.70
3905	Precision Timer	Mini	1.40
4250	Programmable Operational Amplifier	Dip	2.25
5070	Chroma Subcarrier Regenerator	Dip	.50
5072	Chroma Demodulator	Dip	.20
75450	Dual Peripheral Driver	Dip	.80
75451	Dual Peripheral Driver	Mini	.40
75452	Dual Peripheral Driver	Mini	.40
75453	Dual Peripheral Driver	Mini	.60
75454	Dual Peripheral Driver	Mini	.80
75491	Quad seg driver for LED readout	DIP	1.25
75492	Hex digit driver	DIP	1.25
75493	Four Segment LED Driver	Dip	1.40
75494	Six Digit LED Driver	Dip	1.50

7400 series Price Schedule				13	.75	L30	.30	48	1.50	H62	.50	75	1.00	92	1.00	123	1.00	L157	1.25	S174	3.00	L192	2.00
00	.20	H05	.30	14	2.00	H30	.30	50	.20	S64	.50	76	.40	93	1.00	9602	.60	S157	1.50	175	2.00	193	1.50
H00	.30	S05	.50	S15	.50	32	.25	H50	.30	S65	.50	H76	.60	L93	1.25	125	.70	158	2.00	S175	3.00	L193	2.00
L00	.30	06	.40	16	.40	37	.35	51	.20	70	.30	H78	.80	94	1.00	126	.70	160	1;50	176	1.00	194	1.50
S00	.50	L06	.50	17	.40	38	.35	L51	.30	71	.35	L78	.80	95	1.00	132	3.00	161	1.50	177	1.00	195	1.00
01	.20	07	.40	20	.20	39	.60	H51	.30	H71	.50	83	1.00	L95	1.25	S140	1.50	L161	2.00	178	3.00	L195	1.50
H01	.30	08	.20	H20	.30	40	.20	H52	.40	L71	.50	85	1.50	96	1.00	141	1.50	162	1.50	179	3.00	196	2.00
02	.20	H08	.30	L20	.30	H40	.30	53	.20	72	.35	L85	2.50	L98	2.00	145	1.25	163	1.50	180	1.00	197	2.00
L02	.30	09	.20	S20	.50	S40	.50	H53	.30	H72	.50	86	.35	100	1.50	150	1.25	164	2.00	181	3.00	198	2.00
03	.20	10	.20	H21	.40	41A	1.00	54	.20	L72	.50	L86	.50	107	.40	151	1.00	L164	2.50	182	1.00	199	2.00
L03	.30	H10	.30	H22	.40	42	.90	H54	.30	73	.40	S86	.60	109	.90	152	3.00	165	2.00	184	2.00	200	7.00
S03	.50	L10	.30	S22	.50	L42	1.50	L54	.30	H73	.55	88	5.00	S112	1.50	153	1.00	L165	2.50	185	2.00	S200	9.99
04	.20	S10	.50	23	.40	43	1.50	L55	.40	L73	.55	89	3.00	S113	2.00	S153	1.50	166	1.50	189	3.00	251	1.75
H04	.30	11	.20	25	.40	44	1.50	H55	.40	74	.45	90	1.00	S114	2.75	154	1.50	170	3.00	190	2.50	284	4.25
L04	.30	H11	.30	26	.40	45	.90	60	.30	H74	.60	L90	1.25	121	.50	155	1.00	173	2.00	191	3.00	285	4.25
S04	.50	S11	.50	27	.40	46	1.50	H60	.50	L74	.60	91	1.00	9601	.40	156	1.00	L173	2.50	192	1.50	8288	2.50
05	.20	12	.50	30	.20	47	1.50	H61	.50	S74	.80	L91	1.25	122	.75	157	1.00	174	2.00			8880	1.50

Brand New CMOS		74C42	2.75	74C89	12.75	74C162	3.00	74C195	3.00	Cd4002	.50	CD4013	1.10	CD4021	3.75	CD4035	2.75
74C00	.50	74C73	1.50	74C95	3.50	74C163	3.00	74C901	1.25	Cd4006	3.75	CD4014	3.75	CD4022	4.00	CD4037	2.75
74C02	.50	74C74	1.10	74C107	1.60	74C164	4.00	74C902	1.25	CD4007	.75	CD4015	3.75	CD4023	.50	CD4040	4.75
74C04	.75	74C76	1.60	74C151	3.00	74C165	4.00	74C903	1.25	CD4008	3.75	CD4016	1.10	CD4024	2.75	CD4042	2.75
74C10	.50	74C83A	3.25	74C154	5.00	74C173	3.75	74C904	1.25	CD4009	.80	CD4017	3.00	CD4025	.50	CD4044	2.75
74C20	.50	74C85	3.25	74C157	2.50	74C174	3.75	80C95	1.50	Cd4010	.80	CD4018	4.75	CD4027	1.60	CD4049	1.10
74C30	.50	74C86	1.25	74C160	3.00	74C192	5.00	80C97	1.50	CD4011	.50	CD4019	1.20	CD4029	5.75	CD4050	1.10
				74C161	3.00	74C193	5.00	CD4001	.50	CD4012	.50	CD4020	5.25	CD4030	1.10	CD4116	1.30

DTL SPECIALS

930	Dual 4 Gate/Exp	.18
932	Dual 4 Buffer	.18
933	Dual 4 Extender	.18
935	Hex Inverter/Exp	.18
936	Hex Inverter	.18
937	Hex Inverter Gate	.18
944	Dual Buffer	.18
945	RS Clocked FF	.25
946	Quad 2 Gate	.18
948	RS Clocked FF	.25
949	Quad 2 Gate	.18
957	Quad Buffer	.20
958	Quad Power Gate	.20
961	Dual 4 Gate/Exp	.18
962	Triple 3 Gate	.18
963	Triple 3 Gate	.18
9093	Dual JK FF	.34
9094	Dual JK FF	.34
9097	Dual JK FF	.34
9099	Dual JK FF	.34

Memories

MM 5260	1024 bit RAM (2nd generation 1103)	5.00
p1101	256 bit RAM	2.00
p1103a	1024 bit RAM	7.00
7489	64 bit RAM	2.75
8223	256 bit bipolar Field PROM	6.00
8225	64 bit RAM	3.75
74200	Tri-State 256 bit RAM	9.25
DM8599	Tri-State 64 bit RAM	3.75
p2102	1024 bit static RAM	15.00
2602	1024 bit Static RAM	16.00

Request orders . . .
We sell many items not listed, & can obtain many not kept in stock. If you need any odd or hard to find ICs, odds are we can get them. Please write.

NOTES:

a. At Last! A tested 1103! Our newly proven program allows us to offer the only mail-order available, fully tested and guaranteed 1103 in the world!

b. Occasionally, we become backordered in a particular item while overstocked in its H,L,or S equivalent. To alleviate this difficulty, we will follow the policy of free functional substitution when necessary, *unless you indicate that a substitution is unsatisfactory in your application!*

TERMS: Payment with order. Credit available for rated firms upon inquiry. All ICs, unless otherwise noted, are fully tested and guaranteed.

WEIRNU
Box 1307
Colton, CA 92324
ph #(714) 888-2467
(ask for FANNIE!)

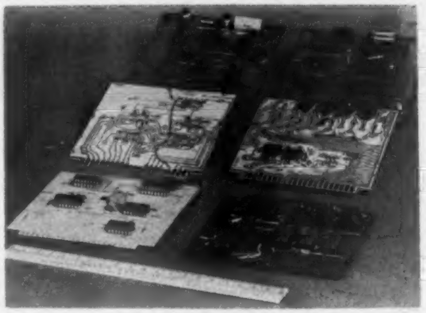
–spec sheets .25¢ each
–our complete catalog $2.00, free with order of $100.00
–Calif. residents add 6% sales tax
–add $1 postage on orders under $10

TAKE 10(N)% DISCOUNT ON ORDER OF OVER 10^N $s; N-1,2,3

expense, however, by noting that this is a very special case. I had to subtract 2 only from the numbers 6, 7, 8 and 9. Table II lists the settings of the CHANNEL B switch for each step in the 2m band. Also listed are the BCD numbers that I wanted to display. Note that in the 1-columns of both numbers each bit is the same. I made no changes to the 1000-1 line (1000 kHz 1 line). Note also that the 2-columns are just the inverse of each other. For this line I simply inverted the output from the CHANNEL B switch during receive. The 4-column of the desired display is always a "1" and the 8-column is always a "0." This was easy to implement by permanently wiring the display input for a "1" on the 1000-4 line and a "0" on the 1000-8 line. IC 56 and IC 57, both 7400 NAND gates, create this very special "subtract 2" circuit. This one will not work for numbers other than 6, 7, 8 and 9.

Digital Display

The five digit display uses five Minitron seven-segment read-outs with three 7447 seven-segment decoder-drivers. Fig. 13 is the schematic of the display. The power for the Minitrons was taken from the 12-15 VDC source through a zener regulator circuit. With only 5V on the Minitrons, the display could not be read in sunlight. 7V makes the display easily readable and does not exceed the maximum of 9V. The lifetime of the filaments must be derated but I have no information regarding this. The 14 of 14X.XX is permanently wired into the display, reducing the number of 7447's required. The three 7447 ICs that are used are blanked when an out-of-lock condition occurs.



Most of the circuitry was done on printed circuit boards. Six of the boards are shown here. Starting at the top, left to right, the boards are the T/R board, 10 kHz latch, 100 kHz latch, Memory, Clock Generator and BCD Encoder.

Frequency	CHANNEL B MHZ				Displayed BCD Number			
	8	4	2	1	8	4	2	1
144.00	0	1	1	0	0	1	0	0
145.00	0	1	1	1	0	1	0	1
146.00	1	0	0	0	0	1	1	0
147.00	1	0	0	1	0	1	1	1

Table II

Squelch Circuitry

The squelch hold circuitry is very simple. A 741 op amp is used as a voltage comparator. Its ouput swings rapidly between 0 and +12V as the squelch voltage from the 220 crosses a preset threshold. This point is adjusted by the setting of the 1K pot, R1. Normally, the signal from the 220 is near 0V. Under that condition, the output of IC 61 will be high (+12) because the inverting input is greater than the non-inverting input. R2 and R3 form a voltage divider to keep

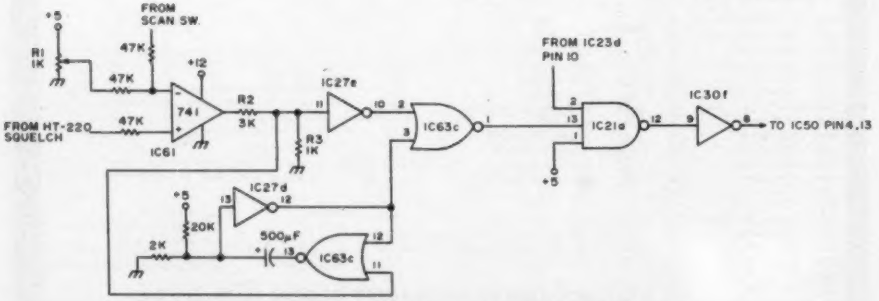


Fig. 14. Squelch Hold. R1 sets the threshold sensitivity.

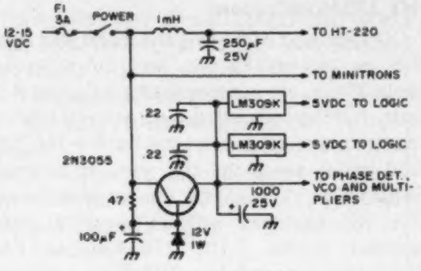

F1
3A
POWER
1mH
12-15
VDC
250µF
25V
TO HT-220
TO MINITRONS
LM309K
5VDC TO LOGIC
.22
LM309K
5 VDC TO LOGIC
.22
2N3055
TO PHASE DET.,
VCO AND MULTI-
PLIERS
1000
25V
47
100µF
12V
1W

Fig 15. Power Supply.

the input to the TTL chips less than 7V. With the multiple inversions in IC 27e – IC 30f, the output of this squelch hold circuit is high (+3) when the HT-220 receiver is squelched. Since this output is the clock for IC 50 and IC 55, the latches do not hold the frequency. When a carrier is encountered the latches freeze the data. IC 27d, IC 63c and IC 63a form a one-shot multivibrator which is triggered by the disappearance of the carrier. It holds the latches in the "frozen" state for about three seconds after a carrier drops out. This allows you to listen to both sides of a conversation even though one side may be slow picking up the mike. This 3 second delay must be eliminated when not scanning, otherwise the time required to go from receive to transmit would be 3 seconds. This inhibiting mode is accomplished by setting the threshold in the 741 op amp much higher when not scanning. The squelch signal from the 220 can never reach it. A second input to the inverting input is activated when not scanning (raised to +5V).

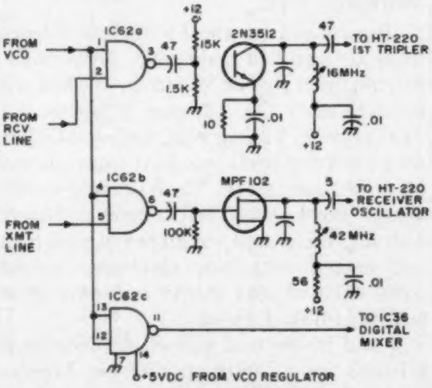
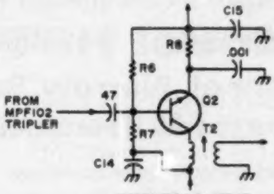

+12
IC62a
FROM
VCO
1
2
3
47
15K
1.5K
2N3512
47
TO HT-220
1ST TRIPLER
16MHz
10
.01
.01
+12
FROM
RCV
LINE
IC62b
4
5
6
47
100K
MPF102
5
TO HT-220
RECEIVER
OSCILLATOR
FROM
XMT
LINE
42 MHz
56
.01
+12
IC62c
13
12
11
7
14
TO IC36
DIGITAL
MIXER
+5VDC FROM VCO REGULATOR

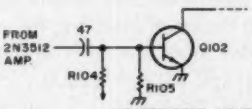
Fig. 16. Buffer/Multiplier.

Power Supply

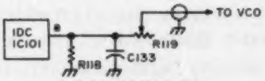
The transceiver was designed to operate from 12-15 VDC. The HT-220 board works better near the high end of this range, although I have experimented with it and can go as low as 11V with mine. The +5V for the IC packages is supplied by two LM-309K regulators mounted on the rear of the cabinet. The TTL load is evenly split between the two. A separate LM309H was used for the VCO and was mounted on the board with the oscillator. To keep ignition noise out of the rig and to provide more stable operation, the +12 regulator from K2OAW's article was also used. Fig. 15 shows the power system.


C15
R8
.001
R6
FROM
MPF102
TRIPLER
47
Q2
R7
T2
C14

RECEIVER L.O. INPUT


FROM
2N3512
AMP.
47
Q102
R104
R105

TRANSMITTER INPUT

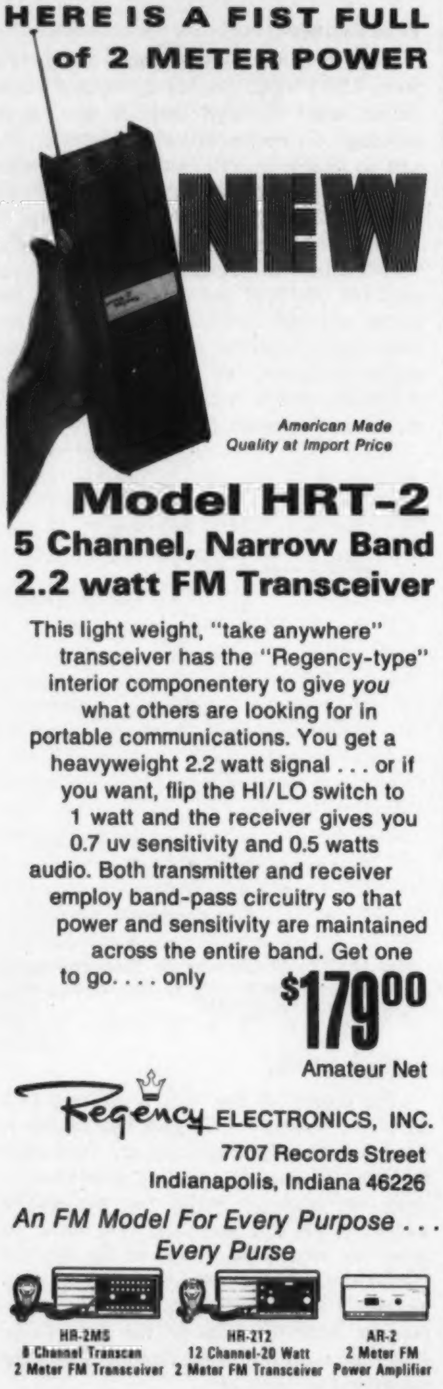

IDC
IC101
TO VCO
R119
R118
C133

AUDIO OUTPUT TO VCO

Fig. 17. HT-220 Connections. These connections are just one method for mating the synthesizer to the HT-220.

Buffer/Multiplier

The output of the VCO is buffered first by IC 62, a quad-NAND gate. One section is used to drive the digital mixer. Two more sections are used as switched amplifiers to drive the transmit buffer and the receive tripler. A 2N3512 was used as a buffer to drive the first tripler stage of the HT-220 transmitter. The 14 MHz output is tripled in an MPF102 stage before going into the receiver oscillator stage of the 220. These stages are right out of the Bandbook and are shown in Fig. 16.



HERE IS A FIST FULL
of 2 METER POWER

NEW

American Made
Quality at Import Price

Model HRT-2
5 Channel, Narrow Band
2.2 watt FM Transceiver

This light weight, "take anywhere" transceiver has the "Regency-type" interior componentery to give *you* what others are looking for in portable communications. You get a heavyweight 2.2 watt signal . . . or if you want, flip the HI/LO switch to 1 watt and the receiver gives you 0.7 uv sensitivity and 0.5 watts audio. Both transmitter and receiver employ band-pass circuitry so that power and sensitivity are maintained across the entire band. Get one to go. . . . only

$179.00
Amateur Net

Regency ELECTRONICS, INC.
7707 Records Street
Indianapolis, Indiana 46226

An FM Model For Every Purpose . . .
Every Purse

HR-2MS
8 Channel Transcan
2 Meter FM Transceiver

HR-212
12 Channel-20 Watt
2 Meter FM Transceiver

AR-2
2 Meter FM
Power Amplifier

HT-220 Modifications

My method of feeding the 220 board may not be the best or only way but it works well. If you are contemplating a rig like this one, I recommend that you acquire both a transmit and receive crystal for the HT-220 and get it tuned up and working to your satisfaction. I modified the original board for 2m operation with information from another article ("The 220 Amateur FM Rig," rpt. . .,September, 1971). In addition to the padding and audio modifications, I made some of my own changes. The transmit oscillator circuit was removed entirely and the input was connected directly to the base of the first tripler. The receiver oscillator was changed by disconnecting the "rubbering" circuit and bypassing the emitter of the transistor with a .001 μf disc capacitor. The 42 MHz input was connected to the base of the original oscillator. The coupling capacitor from the audio IC was connected to a shielded line and run to the VCO board. The squelch signal was taken from the base of Q12, the first audio amplifier. I was optimistic and mounted an S-meter on the FS-220, but up to this time I have not succeeded in coming up with a suitable means of driving it from the 220. A discriminator meter was easily wired in, however. Fig. 17, shows the connections made to the HT-220. A schematic is not given since so many different versions of this little rig exist.

Mechanical Work

The cabinet for the FS-220 was formed from a piece of aluminum 3mm thick. Starting with a piece 59.2cm by 24.3cm and bending as in Fig. 18, gave a cabinet size 21.6cm wide, 12.7cm high, and about 33cm deep. The top cover was bent from another piece of 1.6cm stock. The holes in the main chassis were punched before bending. Before painting, the chassis was etched in a lye bath and coated with zinc chromate. Several spray coats of blue enamel and some white lettering finished the job.

I said in the first part of this series that this was not a construction article. I meant that I did not think anyone would copy it bolt for bolt. With all parts purchased new, rather than relying on surplus and several years worth of junkbox material, the cost of this transceiver would be high. It is certainly not necessary to have all plug-in boards enclosed in Vector EFP modules as I have done. Furthermore, my method of construction makes for much wasted space, but that is the way I wanted it on a prototype such as this.

Results

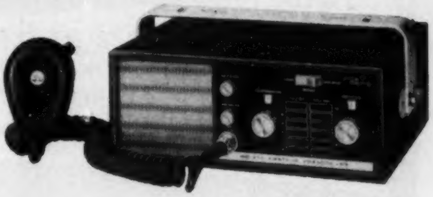
This rig has been operational for several months. It is a real joy to have around. I have discovered repeaters in the south-west Ohio area that I never knew existed. On trips the FS-220 has provided many hours of enjoyment without worry about being "crystalled up" as I have so often heard mentioned. I don't carry my repeater direc-

IC #	Type	IC #	Type
1	7400	34	7475
2	7400	35	74121
3	7400	36	7486
4	7402	37	7400
5	7402	38	7495
6	7402	39	7495
7	7402	40	7495
8	7402	41	7495
9	7404	42	7495
10	7404	43	7495
11	7404	44	7495
12	7490	45	7404
13	7490	46	7476
14	7490	47	7400
15	7490	48	7400
16	74192	49	7400
17	74192	50	7475
18	74192	51	74192
19	74192	52	7400
20	7420	53	7400
21	7410	54	7400
22	7474	55	7475
23	7402	56	7400
24	7476	57	7400
25	7410	58	7447
26	7404	59	7447
27	7404	60	7447
28	74192	61	741 op amp
29	7400	62	7400
30	7404	63	7402
31	7400	64	LM309K
32	7476	65	LM309K
33	74121		

Table III

Integrated Circuit Types

Regency HR-212



American Made Quality at Import Price

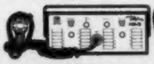
The Incomparable 12 Channel 2 Meter FM Transceiver

Here's an outstanding value that delivers 20 Watts of 2 meter FM power. The unique front panel mode switch enables predetermined or independent paired frequency operation. LOCK mode provides full 12 channel transceive on frequency pairings normally used in your area. UNLOCK mode permits up to 144 possible frequency combinations. The receiver gives 0.4 µv sensitivity and 3 watts audio output. All of this for only

$259.00
Amateur Net

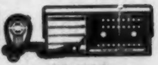
Regency ELECTRONICS, INC.
7707 RECORDS STREET
INDIANAPOLIS, INDIANA 46226

An FM Model For Every Purpose . . . Every Purse



HR-6
12 Channel-25 Watts
6 Meter FM Transceiver

HR-220
12 Channels-10 Watts
220 MHZ FM Transceiver



HR-2MS
8 Channel Transcan
2 Meter FM Transceiver

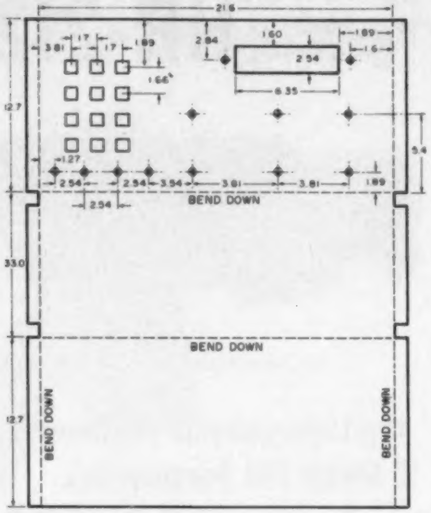


Fig. 18. The more important mechanical features are shown here to illustrate the technique used to construct the chassis (not to scale).

tory with me anymore. The scanner quickly tells me where the activity is.

All is not rosey, however. There are some draw backs to this rig (and similar synthesizers). If a repeater is encountered that is off frequency, you may be the only one who can't use it. So often the users "rubber" their crystals to match the repeater and then it doesn't matter what the frequency is, right? Good grief!

I have already considered modifications to this ultimate rig to improve it or make it more versatile. The VCO has some residual noise on it. The 1.111 kHz reference is still in there, but from reports it is apparently below the level of the alternator whine on many mobiles. I don't have my reference crystal in an oven and the warm-up time is too long on cold winter mornings (10 minutes). The next step is a read-only-memory (ROM), possibly reprogrammable, for all the standard FM frequencies. Scanning would then be faster and more efficient.

My thanks to the Dayton area FMers for tolerating the testing phase on this rig. Thanks also to WA8LSR for the photographic work on this article. Then there are the wife and kids, who put up with yet another construction project and occasionally left bits of food and drink at the top of the cellar stairs.

. . . W8KBC

RF HOT DOG

Using a neon to indicate the presence of rf is well known, and some amateurs are known to keep a neon near a tank, tuner, or end-fed antenna, watching it glow as they tune up. Unfortunately, a neon bulb by itself does not work well with weak rf.

The glowing nose of the "Hot Dog" is enormously sensitised by applying enough ac to get it started. In Fig. 1, each resistor is 3.3 MΩ. Electrically, both could be in one lead, or they could be at the neon end of the flexible cord. Having them at the plug end and taping them up inside gives a neater and safer piece of equipment for obvious reasons.

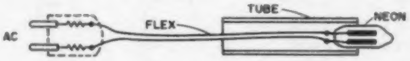


Fig. 1. This is all you need for a sensitive rf indicator.

The neon was a small one from a worn out soldering iron. Any neon will work, though the type with two small, nearly parallel inside electrodes (NE-2) seems best. The piece of insulated tube is only to cover joints and form a handle. Operation ought to be tried before finally sealing up the resistors. The idea is to use very high values, so that the neon barely glows with no rf nearby. The resistors need not be of the same value, and would be expected to be from 2 to 5 MΩ each.

The Hot Dog sniffs out rf like an ordinary neon, but responds to weak rf, either by a change in glow, or movement of the glow. It allows tuneup of weak or low-impedance rf circuits as well as showing rf hot spots and rf leaks in shielding.

. . .G3OGR

ANNOUNCING

THE NEW MODEL HCV–70FSVFK SLOW SCAN TO FAST SCAN VIEWFINDER MODIFICATION KIT FOR ROBOT*70 & 70A SLOW SCAN TELEVISION MONITORS

Also available for HCV-2A monitors. Covered by U.S. Patent #DD–033468.

NOW – HERE AT LAST – From the Designer of the TEEC HCV–1B SSTV Camera and the HCV–2A SSTV Monitor and other Slow Scan TV Equipment (WB4HCV) comes another quality SSTV product . . .

This kit, when properly installed in the ROBOT* Model 70 & 70A SSTV Monitor, will allow Fast Scan (Sampling rate of Model 80 & 80A or the HCV-1B Camera) viewing on the same CRT display you now watch slow scan on, by a simple flip of a front panel switch. Viewing the scene in real time allows for quick, easy set-up of scene. Allows for razor sharp focus. Displays movement and a picture brighter than the normal p-7 slow scan picture. Allows slow scan to be transmitted while viewing the picture on fast scan.

Easy to assemble kit of parts and full step by step instructions. Nothing else to buy. Save $195 by ordering your HCV–70FSVFK Fast Scan Viewfinder Kit today, instead of a separate monitor to take up more space. You will not only save $195 but you will have the advantage of having both monitoring features in a single cabinet. Picture quality similar to model 60 & 61 viewfinders.

Note: Should be attempted by experienced kit builders only. Can be supplied factory installed for $30.00 additional plus shipping. Turn around time about 3 days after receipt of monitor at factory. Write for details.

ALLOW 2-3 WEEK DELIVERY ON ORDERS WITH PERSONAL CHECKS, 3-4 DAYS ON CERTIFIED CHECKS, MONEY ORDERS, ETC.

PRICE COMPLETE POST PAID IN U.S.A.
SORRY NO C.O.D. ORDERS

$69.95

LATE BULLETIN: The HCV–3KB Slow Scan TV Keyboard will be available by late January 1975. Write for information on reserving yours now. Also – The new improved HCV–1B SSTV Camera and the HCV–2A SSTV Monitor are scheduled to again be available by December 15, 1974. HCV–2B is to have a built-in fast scan viewfinder and HCV–1C will have an auto/manual ALC (automatic light control); grey scale generator and more. Write James Thomas, WB4HCV, for full information at:

Sumner Electronics & Eng. Co. inc.

P.O. BOX 572
HENDERSONVILLE, TENNESSEE 37075
TELEPHONE: 615-824-3235

Vern A. Weiss WA9VLK/WA4BBO
719 West Water Street
Kankakee IL 60901

Experiment in Terror

Mama, check the allocation chart, I'm tuning up!

"CQ CQ CQ DE WA9VLK WA9VLK K"

"WA9VLK DE W1IK K"

"W1IK DE WA9VLK – TNX FER CALL OM – UR 579 AT KANKAKEE ILL KANKAKEE ILL ES NAME VERN VERN – SRI FIST SO SLOPPY, THOUGHT I WOULD COME DOWN TO NOVICE SEG HI. W1IK DE WA9VLK."

"WA9VLK DE W1IK – GE VERN NAME BILL BILL UR 559 RUTLAND VT RUTLAND VT – WHAT U MEAN NOVICE BANDS? NOVICES DWN HUNDRED KC – THIS IS EXTRA CW SEG NW – WX CLDY 34 DEGREES ES RIG EIGHTY WATTS TO DIPOLE – WATSA? WA9VLK DE W1IK."

"BK DE WA6ZDO."

"WA6ZDO DE WA9VLK – GE OM – NAME VERN VERN UR 599 KANKAKEE ILL KANKAKEE ILL BK"

"BK TNX VERN UR 599 DALLAS DALLAS – BILL IS 579 – NAME HR TOM TOM. UR OK VERN . . . THIS SEGMENT WS CHANGED BK TO GENERAL LAST THURSDAY BK"

"BK – WELL TOM, LAST HRD HR WAS THIS WAS NOVICE BAND – OVER TO VT, W1IK DE WA9VLK K"

"WA9VLK DE W1IK – U OMS SHOULD READ MORE – ADVANCED AND UP GOT THIS SEGMENT YESTERDAY – GENERALS ARE 150 KC DOWN. ADVANCED AND EXTRA GOT UPPER 200 . . ."

"BK DE W3BYK"

"W3BYK DE W1IK HW?"

"W1IK DE W3BYK – LISTENING ES HRD U ALL DISCUSSING BAND CHANGES – NEW RULES THIS MORNING GAVE TECHS THIS SEGMENT – EXTRAS ARE UP 150, NOVICES GO 200 DOWN AND GENERALS ARE 250 DOWN HW? – W1IK DE W3BYK K"

"W3BYK DE W1IK – SRI OM FONE QRM – PSE TRY AGN BK"

"Break from WA2EWF"

"WA2EWF DE W3BYK – BETTER QSY OFF TECH CW SEGMENT BK"

"O.K. . . . (slurp, cough, hack) W3BYK from WA2EWF . . . helllllllllloooooooooo, o.k. . . . there we go . . . name here's baker ocean baker runnin' kay-dubya in Brooklyn. Just ah – heard you guys *down* on see-dubya, man, this segment is now extra phone since yesterday so you boys better get off the "For Extras Only" net frequency and get a current copy of QSD magazine. So back to Kankakee and Stern . . . WA9VLK *down* on cw from WA2EWF."

"WA2EWF DE WA9VLK – SURE DO WISH I KNEW WHO HAS THE SEGMENT NOW – WL 73 ES TNX – WA9VLK SK"

"WA9VLK DE W1IK 73 ALL CU AGN – W1IK SK"

"BK 73 OMS W3BYK CL"

"Well . . . good luck all the way around, 73 – QR-Zed the FEO net from WA2EWF."

"WA2EWF DE WA6ZDO 73 ES HPE TO GET IT STRAIGHT GE DE WA6ZDO SK"

"KGX 2237 mobile to base . . ."

. . .WA9VLK.

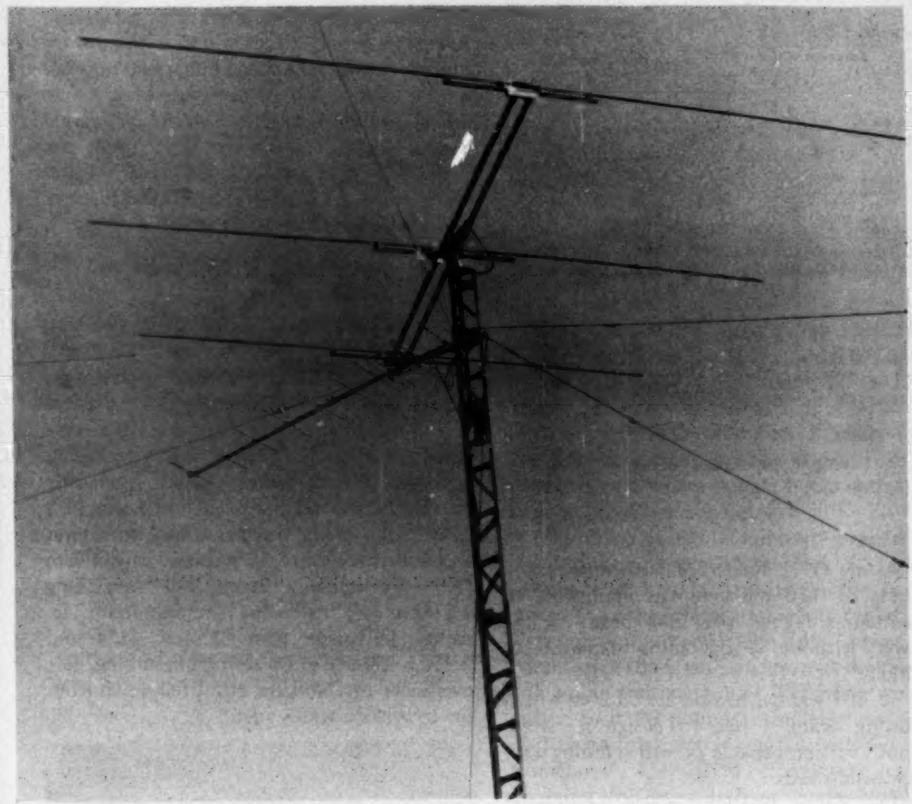
CURTIS KEYER

$24.95?

A remarkable new CMOS IC, created specifically for the CW op bringe Curtis keying within everyone's reach. One 16 pin IC contains all features of the EK-420 (Oct. '73 QST review) . . . self-completing dots, dashes and spaces; iambic option; dot memory; weight control; key debouncing; sidetone and almost zero power drain. You add pots, pwr supply, speaker, chassis and customize as you like.

8043-1 . . . Type 8043 IC, PCB, socket and manual $24.95
8043-2 . . . Above plus partial kit excluding pots, spkr, chassis, jacks, etc. Solid state ±300V, 200mA keying $49.95
Postage anywhere in U.S.A. by air $1.50

CURTIS ELECTRO DEVICES, INC.
Box 4090, Mountain View, CA 94040



Dave Hembling VE7DKR
1379 Columbia Street
Penticton, B.C. V2A 3X7

A Wind-Proof 20m Beam

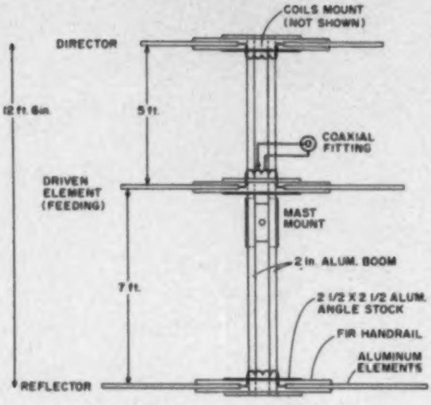

COILS MOUNT (NOT SHOWN)
DIRECTOR
12 ft. 6in.
5 ft.
COAXIAL FITTING
DRIVEN ELEMENT (FEEDING)
MAST MOUNT
2 in. ALUM. BOOM
7 ft.
2 1/2 X 2 1/2 ALUM. ANGLE STOCK
FIR HANDRAIL
ALUMINUM ELEMENTS
REFLECTOR

Fig. 1. Beam construction.

At my QTH due to regular windspeeds in excess of 110 mph, it was impossible to maintain a regular size 20m beam on the tower without it becoming damaged or broken.

So, if I wanted to operate on 20m with a rotating beam, I had to design a "windproof" version capable of withstanding such high windspeeds.

The local weather office windspeed gauges only read to a maximum of 110 mph and according to weather station records over the past dozen years or so, the maximum of 110 mph has been regularly recorded at least 3 or 4 times each year. Based on discussions I have had regarding wind problems experienced in other areas of the world (such as Hawaii), I am not the first ham to face severe wind problems in relation to the erection of a beam for 20m.

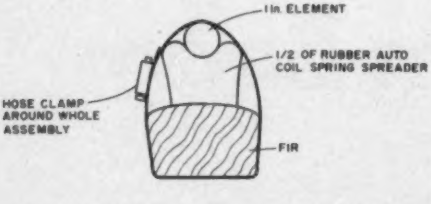
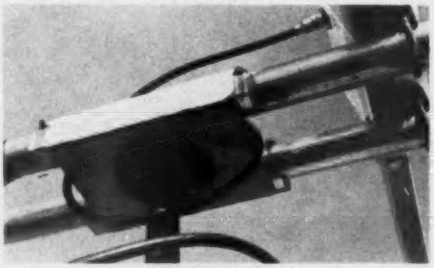

1in. ELEMENT
1/2 OF RUBBER AUTO COIL SPRING SPREADER
HOSE CLAMP AROUND WHOLE ASSEMBLY
FIR

Fig. 2. End view of element mounting to 4' fir pieces.

After numerous disasters with quads and full size beams I developed a windproof minibeam which has been unharmed now for a year and a half. Based somewhat on an ARRL minibeam (*The ARRL Antenna Book*, ARRL, Newington CT, 1964, pp. 275-276), the present windproof version takes advantage of several additional features not utilized in the model which inspired it.

Physical Construction

A "double barrel shotgun" style boom was made from two 45.72m (12½ foot) lengths of 5.08cm (2") aluminum irrigation tubing, see Fig. 1. Three pieces of 5.24cm (2½") x 5.24cm (2½") aluminum right angle stock, 30.48cm (12" long), were attached to the two booms with U-bolts, with the outside of the booms spaced 17.78cm (7") apart. Each of the three elements, which has a coil in the centre, is mounted on 5.08cm (2") fir stairway hand rail measuring 10.16cm (4') in length. The aluminum elements are made from 2.54cm (1") and 2.22cm (7/8") O.D. aluminum tubing, left over after my Gotham beam fell down from the tower one windy night.



Special mounting channel fastened to the double boom with hose clamps.

The elements, although of different lengths when tuned, are each made exactly the same initially, except for the coils. Two 1.83m (6') lengths of 2.54cm (1") O.D. tubing are mounted on the fir hand rail with a 12.7cm (5") space between their inner ends. The outer ends of the 2.54cm (1") tubing are split about 3.18cm (1¼") and the 2.22cm (7/8") O.D. tubing can later be inserted and held at the desired length with hose clamps.

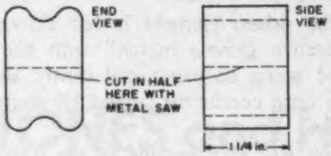
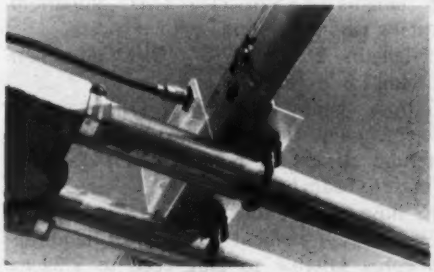


Fig. 3. Hard rubber coil spring spreaders.

The two 2.54cm (1") tubing lengths, 1.83m (6') each, are mounted to the fir with rubber stand-offs, made from hard black rubber auto coil spring spreaders cut in half so as to leave one side flat and the other with a round groove into which the elements fit, see Fig. 2. The original rubber spreaders cost 40¢ each at the local hardware store, and 6 are needed, see Fig. 3. The fir sections are mounted to the right-angle aluminum pieces in two ways. The driven element section is mounted differently than the other two elements. The right-angle piece is bolted to the two booms with 5.08cm x .95cm (2" x 3/8") U-bolts; then the fir section is bolted to the opposite surface of the angle with two chromed .95cm (3/8") bolts.



Driven element as viewed from below.

The aluminum angle stock is U-bolted to the ends of the two booms so that the opposite angle surface forms covers over the ends of the boom tubings. The fir sections are bolted onto the same surfaces as the U-bolts (for the two end elements only).

The mast used was a 5.08cm (2") diameter 1.83m (6') length of water pipe threaded and screwed into a flange plate. The threaded joint was then welded. Then the round flange plate was bolted to a piece of (homebrew) channel made by welding two 35.56cm (14") lengths of 3.81cm x 3.81cm x .48cm (1½" x 1½" x 3/16") angle iron to a 17.78cm x 30.48cm (7" x 12") piece of .32cm (1/8") sheet iron.

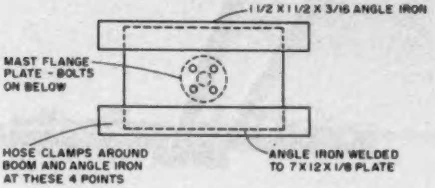

1 1/2 X 1 1/2 X 3/16 ANGLE IRON
MAST FLANGE PLATE - BOLTS ON BELOW
HOSE CLAMPS AROUND BOOM AND ANGLE IRON AT THESE 4 POINTS
ANGLE IRON WELDED TO 7 X 12 X 1/8 PLATE

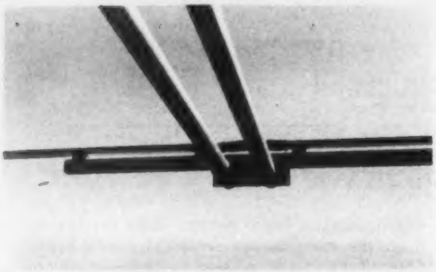
Fig. 4. Mast to boom mount. Beam is removed from the mast by removing the four 1-1/2 x 5/16 bolts used to secure flange plate to home-brewed fixture illustrated here.

The angle iron protrudes 2.54cm (1") beyond the ends of the sheet iron and can be hose-clamped to the double boom with four large hose clamps, see Fig. 4.

The beam is easily removed from mast and tower by removing the four 3.81cm x .79cm (1½" x 5/16") bolts on the flange plate. The complete beam is easily raised and lowered from the 12.19m (40') tower by means of a rope, with one man at the top of the tower and one below. The beam weighs only about 20 pounds complete, less mast and flange plate. It is rotated with a husky homebrew 1/4 RPM homebrew rotor, enabling utilization in high winds. Probably the HAM-M or ROTO BRAKE models would be ideal for use in high winds also. In low wind areas a heavy TV type rotor would be adequate.

Electronics

Loading coils are used at the mid-points in each of the three sets of elements. The idea in this beam is to use an inductance to effectively "shorten" the total element lengths. Although each element could be extended out and clamped with only 15.24cm or 20.32cm (6 or 8 inches) of overlap to give element lengths of 7m (23 feet) or so, only the reflector comes near that length. Element lengths used on my version are given below. Actually, the element lengths utilized are not critical, so long as the appropriate element length/coil resonance combination is utilized. Ordinary 2.54cm (1") diameter B&W coil stock was



Director element, showing rubber mounting of each half element, with clamps and bicycle inner tube over the loading coil.

used with a 30.48cm (12") length of bicycle inner tube later cut and placed over the coils (on Director and Reflector only) and tied tightly around 2.54cm (1") aluminum ends, for weather protection of the coils. The D.E. coil is made of much larger and heavier 5.08cm (2") B&W coil stock, which when soldered is self supporting and left open to weather.

The Reflector and Director loading coils were both made from 2.54cm (1") B&W coil stock, close spaced #20 wire, so as to resonate the Reflector 500 kHz below center frequency desired and the Director 500 kHz above center frequency desired.

The reflector coil consists of 13 turns of 2.54cm (1") diameter B&W coil stock 2.22cm (7/8" long) with each half of the element 3.25m (10'8"). A space of 12.7cm (5") is left between the two halves of the element, for a total reflector element plus coil "wingspread" of 6.63m (21'9").

The director coil consists of 16 turns of 2.54cm (1") diameter B&W coil stock 2.54cm (1" long), with each half of the element measuring 2.27m (7'5½"). A space of 12.7cm (5") is left between the two halves of the element, for a total director element plus coil "wingspread" of 4.67m (15'4").

The driven-element coil consists of 8½ turns #14 on 5.08cm (2") diameter 1.9cm (3/4" long) of B&W stock with each half of the element measuring 2.86m (112 ½"). A space of 12.7cm (5") is left between the two halves of the element, for a total driven-element plus coil "wingspread" of 5.84m (19'2").

Feeding and Tuning:

The driven element is fed through an "inductive gamma match" with the coax shield going to exact coil centre and the inner coax conductor tapped 1½ turns from center.

The RG 8/U feedline to the transceiver should be a multiple of a ½ wavelength of coax. For example, at 14.1 MHz it would be 14.02m (46'), one wavelength, 21.03m (69'), 1½ wavelengths, or 28.04m (92'), 2 wavelengths, long. The coax is experimentally connected to various tap configurations, once the basic D.E. coil is installed, to obtain best SWR.

Each of the elements is again grid dipped by loosely coupling the dipper to each center coil, once the beam is assembled. The beam should be as high above ground for this adjustment as possible. I did these adjustments on my house rooftop, with the beam sitting on top of the 91.44cm (3') chimney (on a rare windless day).

Basic Materials Needed:

2 lengths of 5.08cm (2") O.D. aluminum irrigation tubing 3.81m (12'6") long

6 lengths 2.54cm (1") O.D. aluminum tubing 1.83m (6') long

6 lengths 2.22cm (7/8") O.D. aluminum tubing 1.83m (6') long

6 hose clamps for 2.54cm (1") diameter (element adjusting)

4 hose clamps for 6.35cm (2½") diameter (mast to beam holding)

12 hose clamps for 7.62cm (3") diameter 2.54cm (1") element pieces to fir hand rail

6 corks suitable to plug ends of 2.22cm (7/8") aluminum tubing (apply varnish afterward to seal)

Flange plate plus pipe for insertion onto rotor

3 pieces 6.35cm x 6.35cm x .48cm (2½" x 2½" x 3/16") aluminum right-angle stock, each 30.48cm (12") long

2 lengths of 3.81cm x 3.81cm x .48cm (1½" x 1½" x 3/16") angle iron 35.56cm (14" long each)

1 piece 17.78cm x 30.48cm x .32cm (7" x 12" x 1/8") iron plate

coil stock as described in text.

. . . VE7DKR

Eric Falkof K1NUN
96c Charlesbank Way
Waltham MA 02154

TONES and How To Touch Them

As repeaters become more and more sophisticated, the main method of control seems to have standardized around the Touchtone pad. These devices are available from commercial outlets and the friendly 'Phone man. Cost varies and depends upon the source: they can be free or up to $25 for the sixteen button computer console model.

Following are several circuits for using the pads:

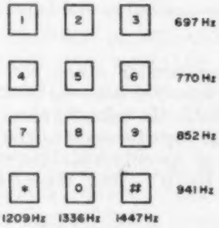

1
2
3
697 Hz
4
5
6
770 Hz
7
8
9
852 Hz
*
0
#
941 Hz
1209Hz
1336Hz
1447Hz

Fig. 1. Button locations and the corresponding audio frequencies produced.

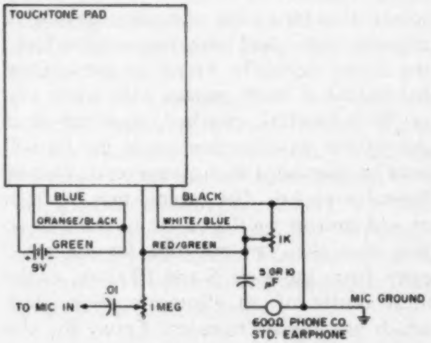

TOUCHTONE PAD
BLUE
BLACK
ORANGE/BLACK
WHITE/BLUE
GREEN
RED/GREEN
1K
9V
.01
5 OR 10 µF
TO MIC IN
1 MEG
MIC GROUND
600Ω PHONE CO. STD. EARPHONE

Fig. 2. Mike's WA4HQW circuit. Adjust 1k pot for clean non-distorted tones. Then adjust 1 meg pot for correct amount of audio to transceiver. HINT: Mike's pad worked with a 330 ohm fixed resistor for the 1k pot.

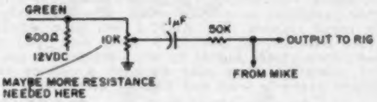

GREEN
600Ω
12VDC
10K
.1µF
50K
OUTPUT TO RIG
FROM MIKE
MAYBE MORE RESISTANCE NEEDED HERE

Fig. 3. Blue and orange-black = ground; black and red-green = together; green = output.

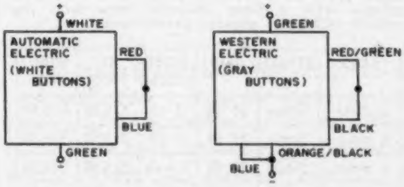

WHITE
AUTOMATIC ELECTRIC (WHITE BUTTONS)
RED
BLUE
GREEN
GREEN
WESTERN ELECTRIC (GRAY BUTTONS)
RED/GREEN
BLACK
ORANGE/BLACK
BLUE

Fig. 4. There are two different wiring configurations for the pads. Pads made by Automatic Electric have one color code and pads by Western Electric, ITT, Northern Electric and Strömberg Carlson have a second code. (The Repeater Journal, Using the TouchTone Pad by WA4WTX.)

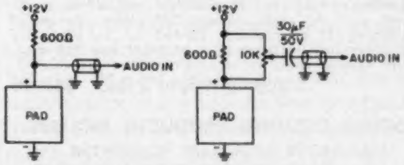

+12V
600Ω
AUDIO IN
PAD
+12V
600Ω
10K
30µF 50V
AUDIO IN
PAD

Fig. 5. There are two ways to connect the pads to the transmitter audio input.

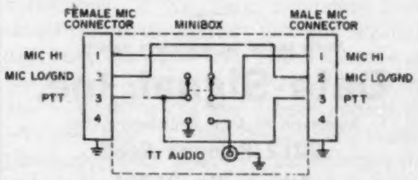

FEMALE MIC CONNECTOR
MINIBOX
MALE MIC CONNECTOR
MIC HI
MIC LO/GND
PTT
1
2
3
4
1
2
3
4
MIC HI
MIC LO/GND
PTT
TT AUDIO

Fig. 6. In most cases the pad introduces noise into the transmitter if left connected. This noise is usually in the form of vibrator hash or transistor,

DATA SIGNAL

the latest in station accessories

AUDIO AUTOMATIC GAIN CONTROL AMPLIFIER

Is your tape decoder having problems due to input signal variations? If so, eliminate these and other problems caused by weak, strong or varying input signals. The AAGC-1 will take signal levels between 50 mV to 5 Volts and feed a clean rock stable signal to any decoder for perfect operation. Give your decoder a chance to decode properly with our AAGC-1 amplifier.

Shipping Weight 3 oz. $14.95 kit
$19.95 wired

DELUXE RECEIVER PREAMPS

Specially made for both OLD and NEW receivers. The smallest and most powerful single and dual stage preamps available. Bring in the weakest signals with a Data Preamp. Now with improved FET's for greater performance.

BAND	STAGES	GAIN	NOISE FIGURE	KIT PRICE	WIRED PRICE
10 meter	Single	25 dB	2 dB	$15.50	$18.50
6 meter	Single	25 dB	2 dB	$15.50	$18.50
2 meter	Single	20 dB	2.5 dB	$15.50	$18.50
2 meter	Double	40 dB	2.5 dB	$30.50	$36.50
220 MHz	Single	17 dB	2.5 dB	$15.50	$18.50
220 MHz	Double	35 dB	2.5 dB	$30.50	$36.50

CRICKET 1 ELECTRONIC KEYER

A popularly-priced IC keyer with more features for your dollar. Cricket I is small in size and designed for the beginner as well as the most advanced operator. It provides fatigue-free sending and its clean, crisp CW allows for easy copying at all speeds. Turned on its side, the Cricket can be used as a straight key for manual keying. Right or left hand operation. AC/DC.

Shipping Weight 3 lbs. $49.95

OTHER EXCITING PRODUCTS INCLUDE
- TOUCHTONE TO ROTARY CONVERTER
- TOUCHTONE TO TOUCHTONE CONVERTER
- TOUCHTONE PADS
- AUTOMATIC DIALER
- ANTI-FALSING TOUCHTONE DECODER
- AGC AMPLIFIER

Write today for complete details

Data Signal, Inc.
Successor to Data Engineering, Inc.
2212 Palmyra Road
Albany, Ga. 31701
912-435-1764

whine. A DPDT switch can be used to switch the pad into the audio circuit and key the transmitter. With the appropriate connectors and a minibox, the pad connects into the mike circuit with no modifications to the radio.

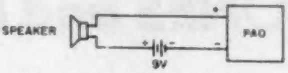


Fig. 7. For use with a walkie talkie, a small speaker can be used for the load resistor and a 9V battery can be used. Since no current is drawn until a button is pressed, a switch is not needed. Battery life is good as the pad draws less than 15mA. Voltages from 4 to 48 can be used on the pad and the frequency will not change. However, 12V is recommended.

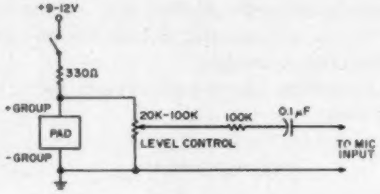


Fig. 8. Information on phone pad hookup for cabon mike input rigs has been published in the April issue of 73. The following circuit works very nicely for high impedance mike input rigs such as most of the all transistorized Japanese ones. (By Alan Tasker WA1NYZ from the WA1KHB Newsletter.

... K1NUN

TOOL AND TIME SAVER

How many times have you needed a special tool for a piece of equipment only to discover that it had long since vanished into the limbo normally found in the average hamshack? A small magnet with a fuse clip or TO-5 heatsink attached, mounted in as out of the way location inside the rig will hold an alignment tool plus several Allen or Bristol wrenches. The magnet may be from an old speaker or if you really want to go first class you can buy one for 10 or 20 cents from the local 5 and 10 store, or the local outlet of an electronic chain store which will remain nameless. Epoxy the clip in place, install the tools the next time you run across them and never again spend half a day looking for the @†$%&! things.

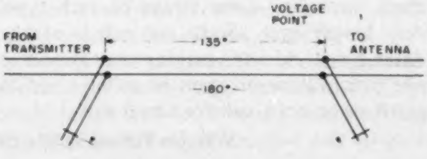
... Bill Turner WA0ABI

Paul Schuett WA6CPP
Box #10
Wallace CA 95254

The Double-Stub Matching System

Looking through the standard reference materials on antennas, the amateur notices a number of interesting antenna configurations that would be fun to try, assuming enough space is available. Commercially built beams and homebrew dipoles are fairly easy antennas to use since the impedance match presents no problem. Most of these can be directly connected to the transmitter output (using coax, of course, unless you can get the rig up there), and you're on the air. The more complex arrays, giving considerable gain and directivity, often do not have a direct 50Ω match, requiring some sort of impedance matching device to make everything perk along at peak efficiency.

There is considerable literature on common matching devices. The coax balun, for instance, gives a 4:1 step up. Toroids can be wired for all sorts of combinations using the transformer-turn-ratio theory. ¼λ transmission line segments act like impedance transformers. Pi, L and T networks can be constructed from coils and capacitors. These projects can be done easily.



The transmission line stub method is also used with great success for matching impedances. Great quantities of information are available on how and where the stub method works. There is another method, the double-stub method, that isn't used too often but is surprisingly efficient and simple. At lower frequencies the single matching stub gets quite long; it isn't such a good idea to have these drag on the ground, especially if you're using open-wire line. The double-stub method reduces the length required. These are actually more convenient to adjust once the initial setup is made. A single stub has to be slid back and forth on the transmission line while the shorting bar has to be slid up and down until the proper match is found. The double stub sets by formula and measurement, and then the final adjustments are fairly easy.

In effect, the double-stub system is a transformer, a ½λ long, extending from closed stub to closed stub. One line begins at one stub, the other ends at the other, with the line in between a "common" winding. The "match" picks the proper impedance off the line at the appropriate point. Obviously, since there is a ½λ between the stubs, they cannot be adjusted independently – the adjustment of one affects the other and both have to be moved simultaneously the same distance and direction to maintain the ½λ separation.

Assume you have built an exotic system, such as a Lazy H or 8JK as described in popular literature. These, along with others, have a tremendously high impedance at the feed point and you want to match to 300Ω open line, converting to 75Ω coax thru a balun. We're using open wire line since it is so much easier for the following steps than using coax would be. We can, of course, apply the same principles to coax and get the same results, but you'll see why open wire will be the choice.

It is fairly easy to get open wire line. A 152.4m (500') roll is not particularly expensive, but be sure to use transmitting type. 300Ω is the most convenient and easiest to get; 600Ω is still made but is fairly expensive. Of course, you can make some spacers or get some of the commercial spacers and make your own line of whatever impedance you may want. Sufficient data exists in standard reference books to come up with about anything you would want.

First, feed the antenna with the open-wire line and go back a convenient distance. You may want to use a precise length, coming to an exact ½λ point, for minimum SWR (tuned line), but if you do the next steps properly, you should get the SWR to 1.1:1 or better.

Next, find a voltage point on the line. Since the line and the antenna are not matched, you will have considerable SWR. Couple a neon bulb to a few turns of wire and move it back and forth on the line while applying a little power (watch those finals!) and when the bulb glows, you're at a voltage point. To make sure, you can go back toward the transmitter and the voltage peak should repeat every electrical ½λ. Remember in verifying to consider the velocity factor of the line. A voltage maximum corresponds to a current minimum, and reactance will be zero at this point. This is where we attach the first stub.

Remember, the distance between the shorting stubs is to be a ½λ. We could attach the second stub almost anywhere down the line toward the transmitter short of 180° (if the stubs were at exact ½λ points, we would lose our transformer action). However, the experts find that for maximum efficiency, we want to go back precisely 135°. Calculate this at the design frequency remembering to multiply in the velocity factor. There are several fairly complicated formulas involving square roots and cosines, but we are not trying to get involved in higher math in this article. Take our word that 135° is the right place! Attach your second stub at this 135° point, and then short the line on the stubs 180° apart. You have a tolerance of ±0.5 λ. Slide both stubs together the same direction in relation to the transmitter to maintain the 180° spacing until you have the proper match. That's it! The stub toward the antenna tunes out the reactance while the stub toward the transmitter is for the proper impedance match.

There are some more formulas that give the active lengths of thy stubs. There are variables, of course; for a start try between 20° and 25° down from the transmission line on the stub for the shorting bar (remember it's important to maintain the 180° between the stubs) and start tweaking from there.

. . .WA6CPP

HEAT SINKS FROM SCRAP

Nearly everyone who works in an office or industrial plant has seen the semipermanent walls and partitions which have become so popular due to the ease with which they may be installed, added to and moved. One of the most popular types consists of panels of laminated plaster-board and various types of aluminum extrusions. These extrusions are provided to attach the panels to the floor, to each other, to seal the top and bottom, make corners, etc., etc.

Several of these extrusions are excellent for making no cost heat sinks for power transistors, diodes, SCR's, and triacs. The spacing of the fins allows the installation of even the largest semiconductors. The next time you see such an installation being made, scrounge some scraps of each type. Any length over about one inch is usable. After a few minutes picking over the scrap pile you will never again be called upon to plunk down cold cash for a heat sink.

. . .William Turner WA0ABI

John Bonar WB2PTD
1606 W. Onondago
Syracuse NY 13205

How You Can Teach Novices

It's easy with the new teaching aids.

Amateur radio is one of the few technical hobbies that is regulated by the government. Because every radio amateur must show a minimum ability in morse code and theory, it is also one of the few hobbies where the beginner will face an almost impossible task unless help is offered by experienced amateurs.

Having taught code and theory courses for several years, I have found them to be helpful and a rewarding experience for both the beginner and teacher. Many hams have the time and knowledge, but lack the final push to start the course. Hopefully the suggestions in this article will provide that push.

The first step is to find a sponsor. This can be the local radio club, a Red Cross Chapter, or RACES. But the sponsor should be the type that would not be willing to take the credit and give the work to the teacher. Generally mentioning that the students will become a source of members for the sponsoring organization will produce results.

The second step is for the teacher to decide how many days he can devote to teaching the course. I found that teaching two days each week is the best way to go. I try as close as possible to cover the same material each night. This allows students to switch from one night to the other night should they be unable to drop by on their regular night. Some weeks the course has an imbalance, but generally each night will average out to an equal number of students. I could tell that the students were getting more out of each session as the weeks progressed, because they were not falling behind due to missing as much as they would have done if I taught on only one night.

Once the nights have been established, then it is important to select the classroom. I have taught in county relief offices, civil defense rooms, rural electric co-operatives and board meeting rooms. The ideal classroom should have a large blackboard, a movie screen, electrical outlets, desks or tables and chairs and good lighting. It should be in a low crime area, there should be parking nearby and someone should be there to let the class in and to lock up. I generally reserve the room from 7:00 to 10:00 in the evening. I try to start out *promptly* at 7:30 with 30 minutes of code practice, and if I am teaching novices, to end with another 30 minutes of code practice. The *official* departure time is 9:30, however, there is almost always an interesting discussion going on that seems to last until 10:00. Reserving the room for 30 minutes before the class starts allows time for ragchewing and sometimes I have held a help session for those who are having a difficult time with the morse code.

I mentioned the time, because some locations that would make ideal classrooms close at 9:00 and this can complicate their schedule and yours.

Some public and private schools will open their doors to non-profit groups. Some libraries have free meeting rooms. Some YMCA, YMHA or YWCA organizations will welcome your class as an addition to their programs. Also some churches have a policy of allowing community groups to use their facilities. The important thing to stress is that the students are generally adults and that you will use their rooms without damage. Check also on a smoking policy. If smoking is allowed, then be sure that ashtrays are available and that they are used. It will win your group with the janitor if you "police" the area after the class is over to avoid leaving soda bottles or cigarette butts on the floor.

Once the room has been reserved, the time picked and the teacher is ready, the next step is the selection of textbooks. I started out teaching with the ARRL publication group "Gateway to Amateur Radio." When the FCC upgraded their test requirements it became difficult to memorize the questions and answers. I then switched to the Ameco "Radio Amateur Theory Course" with improved results. The student could use the same book for both Novice and General license tests. However, the FCC has once again upgraded their tests when they introduced incentive licensing. At present the prospective amateur cannot hope to memorize any textbook and hope to pass. Now the prospective amateur must know and understand the basics of radio theory. Searching for an improved text, I came upon the publications by 73 Magazine. 73 recommends the use of their 5 and 6 wpm code tapes as well as their Novice Theory Cassette Course and their Novice Theory book.

They develop the theory with a minimum of mathematics. And they deal with the study questions furnished by the FCC by amplifying them into easy to deal with questions and then they show how to solve the problems. The illustrations are easy to read and understand. If I had to find fault, then I would point out that a student wishing to go from novice to general needs to purchase two books. However, both texts are excellent study guides and would be welcome in any amateur's reference library.

I have found that while it can be done, it is difficult to run a code and theory course for both Novices and Generals in the same room at the same time. The Novices are left behind by the General theory and code, while the General class students become bored with relearning the basics of theory and code. The General class code and theory course has to be played by ear. The teacher will have to tailor the class to the needs of the class. I have yet to find two classes that act or react in the same manner. I would recommend that the "General Class Study Guide" by 73 Magazine be strongly considered as the text for the class. If the teacher feels ambitious, he may want to also consider the addition of the "Advanced Class Study Guide." (As well as 73's 13 and 20 wpm code cassette.)

The best combination of texts for the Novice class course, I have found to be the "Novice Class Study Guide," and "CW" both published by 73 Magazine. To keep the class current on the FCC rules and regulations, I would suggest 73's reprint of the amateur section of the rules and regulations. The class sometimes tends to become sidetracked with questions on antennas and on operating procedures. Including a copy of ARRL's "Understanding Amateur Radio" will take care of most of the questions that the class might come up with during your theory sessions.

One final word before we begin our search for students to fill the class. The teacher has enough problems without being forced to donate a code practice oscillator as well as his time. If he has one and is willing to bring it to class then I say fine. But I have been in the position of having to purchase an oscillator with cash from my own pocket and that should be the responsibility of the sponsoring group.

The search for students begins with a press release. The press release should be given to the press, but in addition, copies should be given to the club bulletin editor, other local amateur clubs, CB organizations, Boy Scout Troops, Girl Scout Troops, Red Cross Chapters and anyone else that you might think of that would be interested in having an amateur radio license. Word of mouth is a powerful means of communication. Nuns comprised 20% of one of my classes one time. Now I automatically let them know before each course. Wives or husbands of hams are good student material, also. I try for families by requiring that there be at least one set of books per family. And I have had many husband/wife combinations.

The First Night

The first night should begin with a welcome speech and introduction by the teacher. Before they start with their questions, pass out their books to them, collect the money and announce that you will be glad to answer any and all questions after the code session is over. Begin with the letters E,I,S,H,A,W,J. (The reason for this order will be explained later.) These are among the easiest letters in the code. Take it easy and at the end of the code session compliment them on how well they are doing. Your praise and their newly learned code ability will encourage them. Many of their questions will be in two catagories: how much does it cost and how far can they get with just dots and dashes?

You should answer their questions to the best of your ability, and the ones that you would rather not answer (antennas, SSB, etc.) at that time you can delay by telling them that you will be glad to answer their questions, but you feel that they would better understand your answer in a few weeks.

After a 15 minute question session teach them Ohm's Law and the Power formula. Stress and explain that the reason that they must learn to use these equations is that they are not only required knowledge by the FCC, but they are used almost every time a Novice operates. Keep the units basic. Leave the introduction of Mega-, kilo-, milla- and micro- for the next lesson.

ADIRONDACK RADIO SUPPLY, INC.
AND
YAESU

AN UNBEATABLE COMBINATION Call ADIRONDACK RADIO SUPPLY TODAY FOR ALL YOUR YAESU EQUIPMENT... OVERNIGHT UPS DELIVERY TO THE NORTHEAST. CALL 518 842-8350. MASTER CHARGE AND BANK AMERICARD ACCEPTED

ADIRONDACK RADIO SUPPLY, INC.
185 West Main Street, Amsterdam NY 12010
Phone: (518) 842-8350
Serving the radio amateur since 1936

When they leave, they should understand how to use the equations and what the units mean. Assign them the first two chapters in their Novice class study guides to be read for next week. Finish the first class session with a short and simple code test to see if they have learned their letters. Most students will know them and that leaves them with a good feeling and will tend to encourage them to return the next week.

The Second Night

Congratulate them on showing up and begin the code session with a review. This has two purposes. Those who missed the first session will have a chance to catch up. And it begins the session out on a positive note for those who were there the week before. After a brief review, introduce the letters F,V,L,P,R,U. Stress them as well as the letters learned the week before.

Review Ohm's law and the Power formula with them. Then introduce the concept of Mega-, Kilo-, milli- and micro-. Work some problems out with them using the new concepts. At this point, I try to have an active amateur with a General class or higher license in to speak to them and answer their questions. The questions should be allowed to continue until it is time for the code session. They should be assigned chapter 3 for next week. Finish with a good code session.

The Third Night

Review the previously learned letters and then introduce T,M,O,N,D,B,G. The theory session should begin with the concept of frequency and wavelength. Let them know where their bands will be. For a guest speaker, invite the local DXer to come and tell them the DX possibilities that they will have on their bands using 75W CW. Have him bring some of his cards and awards. This will give them a taste for wanting to really get their license and operate. Again finish with a review of the 20 letters that they have learned.

The Fourth Night

Some of your students will be falling behind in their code. Surprise the class and do not introduce the remainder of the letters. Instead, make this class session a review period. Review the letters that you have already taught them and review the theory they have learned. Introduce the formula for the resonant frequency of dipoles. Do not have a guest lecturer for the fourth session. Make certain that you are not leaving anyone behind in a state of confusion. Finish with another code review. Skip chapter four and assign chapter five.

The Fifth Night

Finish giving them the rest of the letters. I feel that the best practice is simple and straight text. Save the code groups for later. The important thing now is to stress accuracy and let their speed build. The guest lecturer should be an experienced Novice or former Novice. By now they will know enough to ask specific questions. The final code session should be straight text again.

The Remaining Sessions

Let the advanced students send to the class to build their sending ability and give the rest of the class experience in hearing fists other than the teachers. The theory sessions should revolve around the FCC regulations, and the guest lecturers should come from the local available talent.

Sometime toward the end of the alotted time, have each student fill out a 610 form. (But don't date them!!)

Give a mock written exam. Try to make it as close to the FCC multiple choice test as is possible. Go over the test with the class and make sure they understand any mistakes that they may have made. Stress always your satisfaction on how they are progressing.

The Final Session

Give them their code test. Those who pass should date their 610 forms. You as the examiner should send in their forms to the FCC. Then you can both fret until the test returns and they have passed.

Hints

The information given here is from my own experience. I have not seen two classes act or react in the same way. I have chosen the order of teaching the code given in the text, because it has cut the time to learn the code by 50% over any other system. (If you have never used this system before, it is based on learning those letters that begin with dot and then those that begin with dash. Try it. It works.)

I do not teach the numbers. They are not required by the FCC for novices and I feel that the process is confusing enough without adding any more confusion. However, numbers and punctuation is not difficult to learn and they can easily pick it up in one session after they have passed their Novice code test.

Teaching a code and theory course will bring you the first of your grey hairs. But it will also bring you many little novice friends and a warm glow inside from having shared our hobby with others. I tried it once and got hooked. I hope that you will too.

. . . WB2PTD

How to win the fist fight... with CW equipment from HAL.

The economical HAL 1550 keyer.

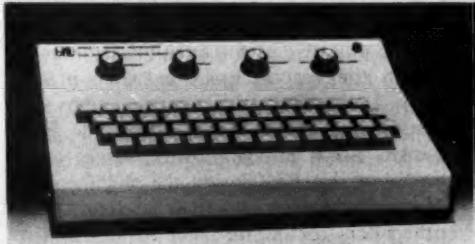
The easy-to-use 1550 keyer is your answer if you're looking for an electronic keyer that lets you send accurate CW effortlessly. Send from 8 to 60 WPM with conventional, iambic, and dot memory operation. Operates with dual or single lever keys. The optional 1550/ID automatically sends "DE" followed by your station call. For fast, accurate CW, order the HAL 1550/ID or 1550 today.

Price: 1550/ID, $95; 1550, $75; ppd USA.
Air shipment, add $3.

ID-1A repeater identifier. Commercial quality, low price.

The HAL ID-1A brings the radio amateur a commercial-quality repeater identifier that complies with FCC ID requirements. It has a unique read-only-memory that you can easily reprogram yourself. Capacity of the ROM is 39 dots, dashes and spaces. TTL IC's assure immunity from noise and temperature. ID intervals available: 3, 6, 12 or 24 min. Specify call.

Price: $115, ppd USA. Air shipment, $3.



Send perfect CW every time with the MKB-1.

A complete Morse keyboard. Code speed variable from 10-60 WPM with variable dot-to-space ratio (weight). All solid-state, featuring computer-grade components. Complete alphanumeric and punctuation keys, plus an optional "DE-call sign" key factory programmed for you. Includes built-in speaker/oscillator monitor.

Price: $290 Assembled, $199 Kit, ppd USA.
Without ID, $250 Assembled, $170 Kit.
Air shipment, $5.

CW—and RTTY on one keyboard! The HAL DKB-2010.

All solid-state. Type out CW at 8-60 WPM. Adjustable dot-to-space ratio (weight). Complete alphanumeric keys, plus 11 punctuation marks. Five standard two-character keys, 2 shift keys, break-for-tuning key, 2 three-character function keys, and a "DE-call sign" key. We'll program your call right into the DKB-2010. Plus complete RTTY capabilities. Built-in three-character buffer. Optional 64 or 128 key buffer also available.

Price: $425 Assembled, $325 Kit, ppd USA.
64 key buffer $100, 128 key buffer $150.
Air shipment, $10.

HAL Communications Corp.
Box 365, Urbana, Illinois 61801
Telephone: (217) 359-7373

Enclosed is $_____ for: ☐ DKB-2010 ☐ MKB-1 ☐ 1550 ☐ ID-1A
Please specify ☐ Assembled ☐ Kit ☐ Options __________
Please send me more information on the following HAL products . . .
☐ DKB-2010 ☐ MKB-1 ☐ 1550/1550 ID ☐ ID-1A
☐ Complete HAL catalog

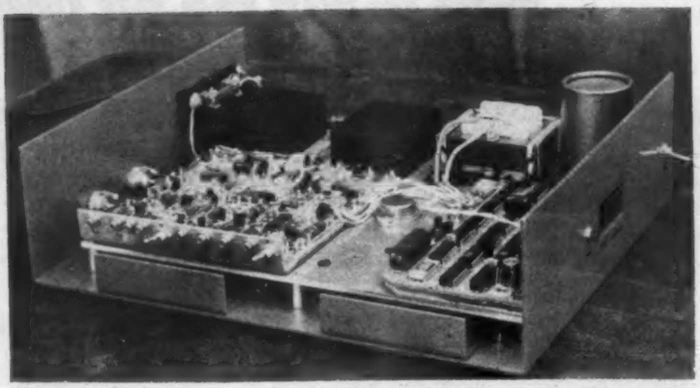
Name ____________ Address ____________ Call Sign ____________

City/State/Zip ____________

Illinois residents add 5% sales tax.

L

A Digital SWR Computer!



Terry Mayhugh W6OTG
537 West Church Street
Ridgecrest CA 93555

Part 1

Although the average ham has to know very little about just how computers actually work he certainly can (and does) take advantage of their capability. Not only might a computer have helped to design some of the equipment in his shack, but he may be using a few special purpose digital computers himself to display the receiver frequency or to send pre-programmed CW messages.

This article describes a special purpose hybrid computer which automatically computes the SWR in a 50Ω coax feedline and numerically displays the answer. An operator using this device does not have to bother flipping switches to get forward and reverse readings while frantically trying to simultaneously tune his transmitter and/or transmatch, as he would on a typical SWR meter. This computer is called a hybrid because it is two computers in one – an analog computer and, if you will, a digital computer. The analog section does the actual SWR computation, and it is described in this article. If a meter type readout is desired this is all that need be built to have a computing SWR meter. Next month, the digital section consisting of an A/D converter and a display will be described.

The objective of the circuit design was to obtain the best accuracy available practically. Thus, some rather exotic op amps and metal film resistors were used in the final design. Some critical resistor values were precision matched during the alignment as described later, and this may be desirable to others constructing the complete instrument with the digital readout. Of course, if a panel meter readout is desired such accuracy isn't required and one could get away with using cheaper 741 type op amps. When you stop and think about it, who wants or needs to know his SWR so accurately? Actually, I don't think anyone does, but the circuitry is interesting and that will be reason enough for many to build the instrument.

Circuit Description

Analog Section

Fig. 1, is a schematic of the analog section. The computer receives two voltage outputs from the RF pickup, V_F and V_R, and then mathematically computes the SWR using the formula:

$$SWR = \frac{V_F + V_R}{V_F - V_R}$$

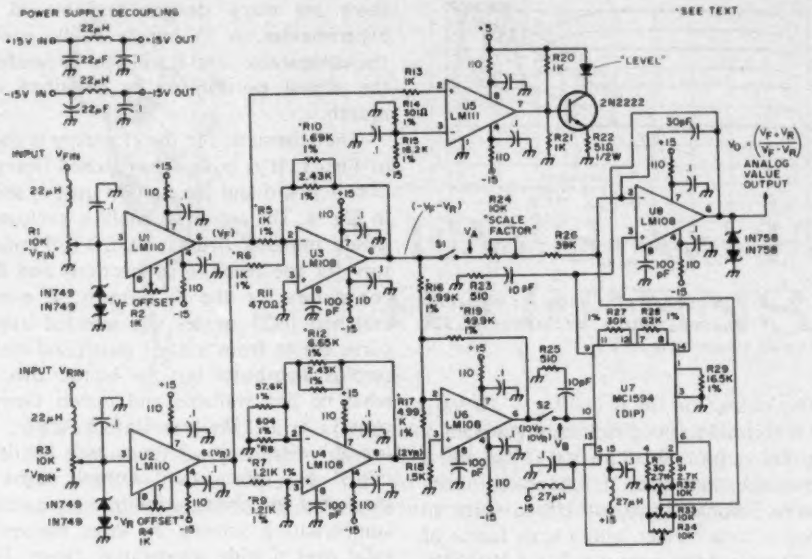

POWER SUPPLY DECOUPLING
+15V IN
22μH
+15V OUT
22μF
.1
-15V IN
-15V OUT
INPUT V_{FIN}
R1 10K "V_{FIN}"
1N749
1N749
U1 LM110
"V_F OFFSET" R2 1K
(V_F)
INPUT V_{RIN}
R3 10K "V_{RIN}"
U2 LM110
"V_R OFFSET" R4 1K
(V_R)
*R5 1K 1%
*R6 1K 1%
*R10 1.69K 1%
2.43K 1%
U3 LM108
R11 470Ω
100 pF
110
+15
-15
*R12 6.65K 1%
2.43K 1%
57.6K 1%
604 1%
*R8
*R7 1.21K 1%
*R9 1.21K 1%
U4 LM108
(2V_R)
R13 1K
R14 301Ω 1%
R15 16.2K 1%
U5 LM111
+5
R20 1K
"LEVEL"
2N2222
R21 1K
R22 51Ω 1/2W
*SEE TEXT
(-V_F-V_R)
S1
V_A
R24 10K "SCALE FACTOR"
R26 39K
R16 4.99K 1%
R23 510
10 pF
*R19 49.9K 1%
*R17 4.99 K 1%
R18 1.5K
U6 LM108
S2
(10V_F-10V_R)
V_B
R25 510
10pF
27μH
U7 MC1594 (DIP)
R27 30K 1%
R28 62K 1%
R29 16.5K 1%
R30 2.7K
R31 2.7K
R32 10K
R33 10K
R34 10K
30pF
U8 LM108
$V_O = \left(\frac{V_F+V_R}{V_F-V_R}\right)$
ANALOG VALUE OUTPUT
1N758
1N758

Fig. 1. Schematic diagram of the analog computer portion of the SWR meter.

The heart of this section is a monolithic analog multiplier chip, the MC1594, used in an analog divider configuration. If the op amps and alignment techniques suggested are used, the accuracy of this portion of the computer will be limited by the accuracy of the divider chip which is less than 1% over a much wider temperature range than the computer will ever see.

U1 and U2 serve as input buffers for V_F and V_R, respectively. U3 is a unity gain summer-inverter and produces at its output the sum ($-V_F - V_R$). Resistors R5, R6 and R10 should be chosen from 1% metal film types to obtain the following ratios as accurately as possible:

$$\frac{R10}{R5} = 1 \qquad \frac{R10}{R6} = 1$$

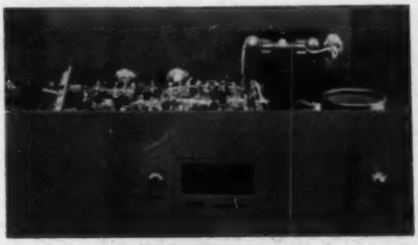
The values chosen for these resistors should lie between 1K and 10K for best results. Because I had several different metal films but not too many of any one value, I chose R5 = R6 = 1K and initially chose R10 a little larger than necessary and then trimmed it later by paralleling another value across it as described in the alignment section.

U4 is a simple precision X2 amp and values for R7, R8, R9 and R12 should be chosen as follows:

$$\frac{R7}{R9} = 1 \qquad \frac{R12}{R8} = 3$$

Again, I chose values for R7 and R9 but then trimmed R12 and R8 during alignment. U6 is a gain-of-10 summer-inverter and its feedback resistors are chosen as follows:

$$\frac{R19}{R16} = 10 \qquad \frac{R19}{R17} = 10$$



A rectangular window is cut in the front panel for the display. A piece of transparent red plexiglass is epoxied in from behind for proper filtering for the LED display. The level indicator lamp is to the left of the window. The completed instrument was housed in a 9" x 3" x 11" homebuilt housing (with cover). BNC connectors for inputs from the rf pickup are on the rear wall. Alignment pots are on the L-bracket at the left.

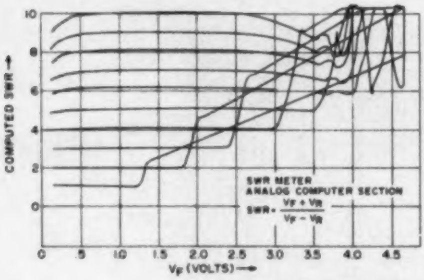


Fig. 2. X-Y recorder plot showing dynamic range of analog section exclusive of RF pickup as a function of V_F.

The output of U6 is $(10\ V_F - 10\ V_R)$, and this is fed to the divider as the denominator. The output of U3 is $(-V_F - V_R)$ and is used as the numerator. U7 is placed in the negative feedback path of U8 to form an analog voltage divider with a scale factor of -10. Therefore the output is $(V_F + V_R)/(V_F - V_R)$.

For best linearity in the divider, R28 should be twice the value of R27. Decoupling networks are used on each IC as well as on the input ports of U1, U2 and U7 to keep the rf out of the computer circuitry. U5 is a comparator which monitors the input level and lights a panel lamp to tell the operator that he is operating within the dynamic range capability of the device. This is necessary since all analog division schemes have good accuracy only over limited dynamic ranges. Fig. 2., illustrates the dynamic range of the analog section.

Regulated ±15VDC supplies at 40mA are needed to complete the construction. Modular supplies were used in the prototype, but there are many designs available to the experimenter. A 5V supply is also used in the comparator, and it will also be needed in the digital portion to be described next month.

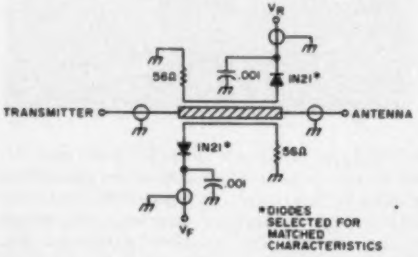


Fig. 3. Schematic of rf pickup. Diodes should be matched for best accuracy.

The schematic for the rf pickup is shown in Fig. 3. It is built on an etched fiberglass circuit board and the pattern used is shown in Fig. 4. The entire assembly is enclosed in a Bud minibox fitted with SO-239 connectors for the feedline connections and BNC connectors for the dc outputs. A pair of matched IN21 diodes was selected using a curve tracer from a bag I purchased from a surplus distributor but the builder may use what he has available and match them as closely as he desires. Unfortunately, the overall instrument accuracy will be determined by this match. Others might be interested in coming up with a temperature compensating scheme to keep the match valid over a wide temperature range. Temperature compensation techniques have never interested me and the rf pickup circuitry that I used shows it.

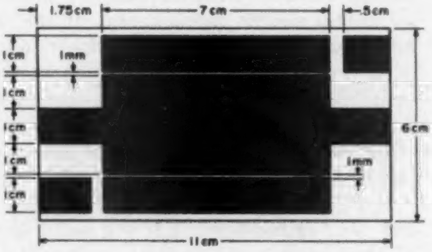


Fig. 4. Foil pattern for rf pickup. Black shaded areas are the foil lanes.

Alignment

Several alternatives are available for alignment depending on the accuracy and the type of readout desired. The following steps provide the most accurate alignment, but a DVM is required. The accuracy of the instrument can be no better than that of the DVM used. If a panel meter readout is desired a VTVM may be used for alignment and precise selection of the op amp feedback resistors is not necessary, although 1% values should be used to obtain the required ratios. The alignment procedure is as follows:

NEWS AS IT HAPPENS

That's just what HOTLINE gives you. Late breaking news is in your hand while it's still happening! Every other Friday, HOTLINE rushes you all the up-to-the-minute info that's so vital to the active ham. At only 30¢ an issue, it's one of the few real bargains still left! And a third of that's for postage! Just what does HOTLINE offer you?

LATEST breaking FCC news
NEW petitions filed
IMMEDIATE job openings
HOT classified ads
BRAND NEW product reports
CURRENT DXpeditions

contest NEWS
hamfest EVENTS
government ACTIONS
propagation FLASHES
everything UPCOMING
convention HAPPENINGS

The fact is HOTLINE gives you all the things you need to know when you need to know them. And that means RIGHT NOW, not two months from now. When we say "news" we mean it! HOTLINE is in the mail hours after the deadline closes, and often in your home the next day.

HOTLINE is by subscription ONLY. For $8 a year, it is delivered to you by first class mail marked "rush – time value." Our tests have shown that this class of mail often arrives sooner than even airmail! HOTLINE is published in professional newspage format and gives you many times the current information available anywhere else.

Get the news while it's still news. SUBSCRIBE TO HOTLINE TODAY!

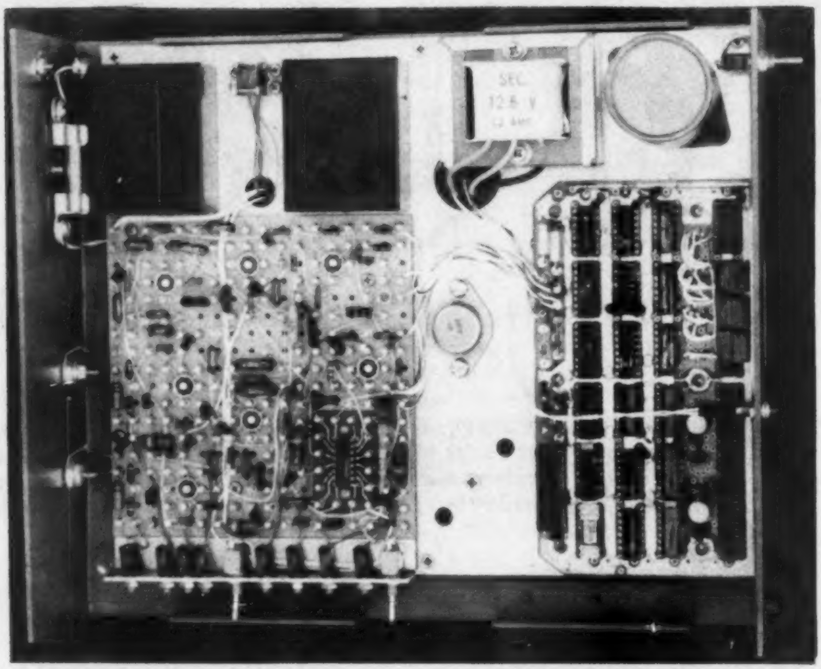
☐ **Yes! RUSH ME HOTLINE TODAY. For only $8 a year! Bill me after I receive my first issue.**

Name ____________________ Call ____________

Address ______________________________

City ______________ State ________ Zip __________

Mail today to
73 Magazine,
Peterborough NH
03458.



The digital board holds the display and is mounted at the front of the instrument. The analog components are mounted on the Vector board at the rear. The two black modules are the +/-15V supplies. The transformer is for the 5V supply.

1) Set controls R1 and R3 to their mid-range positions. Short the V_F and V_R inputs to ground and adjust R2 and R4 to give OVDC at the outputs of V1 and V2, respectively.

2) Apply approximately 3VDC to the V_R input and then adjust R3 for exactly .5VDC out of U2. Then measure the output of U4. Trim R8 and/or R12 until the output measures exactly 1VDC.

3) Measure the output of U3. Trim R10 until this voltage is exactly -.5VDC. Do not change the value of R10 in the following steps.

4) Apply approximately 3VDC to the V_F input and then adjust R1 for exactly .5VDC out of U1. Again measure the output of U3 and trim R5 until the output measures exactly -1VDC.

5) Remove the V_F input and trim R17 and/or R19 to obtain exactly -10 VDC at the output of U6. Do not change R19 in the following step.

6) Replace the V_F input and trim R16 until the output of U6 measures OVDC.

Open switches S1 and S2. The divider circuit will be aligned separately with externally applied voltages.

7) Set V_A = O (ground it) and adjust R33 until the output voltage (V_O) remains at some (not necessarily zero) constant value as V_B is varied between +1V and +10V.

8) Maintain V_A = O volts, set V_X = +10V and adjust R32 until V_O = OV.

9) With $V_A = V_B$ and adjust R34 until the output voltage remains at some (not necessarily -10V) constant value as $V_A = V_B$ is varied between +1V and +10V.

10) Maintain $V_A = V_B$ and adjust R24 until the average value of V_O is -10V as $V_A = V_B$ is varied between +1V and +10V.

11) Repeat steps 7 through 10 as necessary

Come Face to Face with the facts...

IC-21A . . . 24 channel capability, with 7 channels supplied. It's MOSFET front end provides better than 0.4uv sensitivity at 20 db quieting. 5 HELICAL FILTERS virtually eliminate intermodulation. Built in AC and DC power supplies. Modular construction, of course. Many other features make the IC-21 a great two meter transceiver. The IC-21A is capable of using our new digital VFO.

LOW HIGH
AUX MAIN
EXT DIAL
PWR CONTROL
FUNCTION
RECV
XMIT
OFF
PWR
IC-21A
METER
DEVIATION
CAL
MIC
ICOM
MIC GAIN

...and choose ICOM

IC-22 . . . 22 channel capacity, with 5 supplied. Solid state T-R switching, and an extra large speaker. All the great quality features that label it as one of the truly fine ICOM transceivers. 10/1 watt power saving option. Trimmer caps on all 22 channels for both transmit and receive, plus a built in discriminator jack to let you get on and stay on frequency.

The IC-3PA is a regulated DC power supply for all the INOUE mobile transceivers. Use it with your IC-230 for base operation. It's completely regulated and gives you an indication of it's operating condition; normal, excessive current, or if the protection circuit is working. These are shown through the use of eye catching indicator lamps. There is also a built in speaker in the cabinet.

IC-22
ICOM VHF FM
HI
OFF
LOW
MIC
IC-3PA
POWER
POWER
NORMAL
WARNING
CURRENT

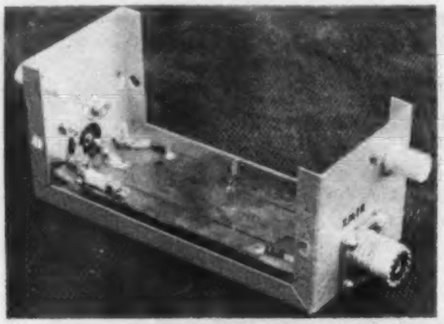
ICOM

Distributed by:

– Dealerships Available –

ICOM WEST, INC.
Suite 232 – Bldg. II
300 - 120th Ave. N.E.
Bellevue, Wash. 98005
(206) 454-2470

ICOM EAST Div. ACS Inc.
Suite 501
13777 N Central Expwy
Dallas, Texas, 75231
(214) 235-0479



The rf pickup is housed in a 2-1/4" x 2-1/4" x 5" Bud Minibox. Cartridge diodes were soldered directly to the pc board.

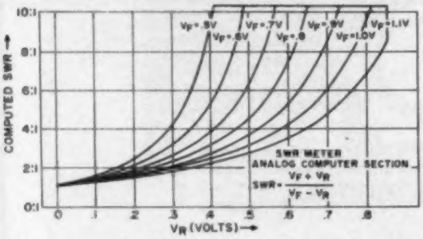


Fig. 5. X-Y recorder plot showing accuracy of analog section exclusive of rf pickup.

to achieve optimum performance.

Close switches S1 and S2 and the analog computer is ready for use. Fig. 5, shows recorder plots of the performance. If a digital readout isn't desired all that remains is to connect a O -10VDC meter at V_O and the rf pickup, and SWR's from 1:1 to 10:1 can be read directly. The outputs are clamped to keep the meter from going off scale at higher SWR's.

R1 and R3 will have to be adjusted one time for the particular transmitter power used. I set R1 so that with about 50 watts dc transmitter input, there was about .3VDC measured at the output of U1. With my SB-401 at full CW power and my particular rf pickup, the maximum value of V_{F1N} is about 3VDC. The level indicator will light with V_F greater than approximately .25VDC so that the input is within the dynamic range of the instrument (as seen from Fig. 2).

The optional second half of the computer will be described next month. Even if you don't want to use it as a display for this instrument, it will make a great DVM for other uses around the shack. ... W6OTG

K-ENTERPRISES

300 MHZ
OFF
ON
PRESCALER
PD-301

PRESCALER MODEL PD-301

$55.50 *plus* $1.50 postage

Model PD 301 is a 300 MHz prescaler designed to extend the range of your counter ten times. This prescaler has a built-in preamp with a sensitivity of 50 mV at 150 MHz, 100 mV at 260 MHz, 175 mV at 300 MHz. The 95H90 scaler is rated at 320 MHz. To insure enough drive for all counters, a post amp. was built-in. The preamp has a self contained power supply regulated at 5.2V + .08%. (Input 50 Ohms, Output Hi Z)

All prescalers are shipped in a 4" by 4" by 1½" cabinet. All are wired and calibrated.

K-ENTERPRISES
1401 NORTH TUCKER
SHAWNEE, OK 74801
405-273-1598

FREQUENCY STANDARD

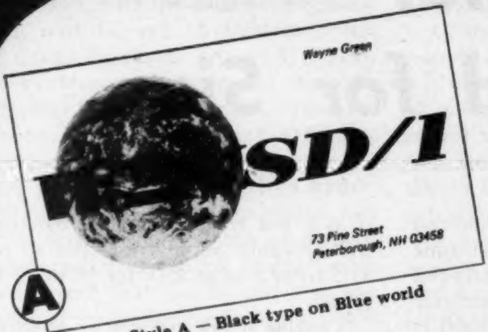
Gnd Out
100
50
25
10
5
Off
Zero
PALOMAR ENGINEERS

Only
$37.50
(less batteries)
POSTPAID USA

- Precision crystal
- Fully guaranteed
- Markers at 100, 50, 25, 10 or 5 kHz selected by front panel switch.
- Zero adjust sets to WWV. Exclusive circuit suppresses unwanted markers.
- Compact rugged design. Attractive, completely self contained.
- Send for free brochure.

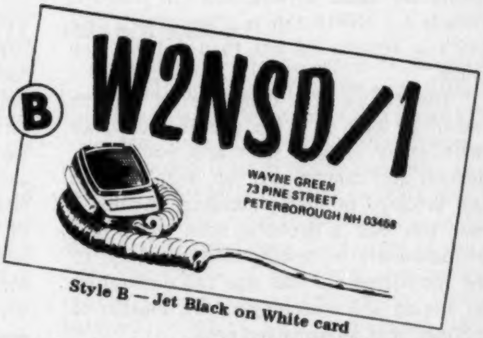
PALOMAR
ENGINEERS
BOX 455, ESCONDIDO, CA 92025

QSLs for 1¢



Style A — Black type on Blue world

- two styles
- QSO info back
- two colors
- LOW PRICES



Style B — Jet Black on White card

While the cost of almost everything keeps spiraling upward, 73 has kept the price of these beautiful QSLs at rock-bottom. When we started selling *Top Quality* QSLs last year for a **PENNY-A-PIECE** (postpaid yet!) it was a fantastic deal; this year it's the next best thing to having an oil well in your own backyard!

ORDER — AND PAY

250	**$6** (2.5¢ ea)
500	**$10** (2¢ ea)
1000	**$15** (1.5¢ ea)
2000	**$20** (1¢ ea)

These QSLs are printed on *Fine Quality Glossy Card Stock* and are as good or better than cards sold elsewhere for several times the price. We can offer this fantastic low price, because we "gang print" orders between other jobs in our own print shop which keeps the costs way down and we pass the savings on to you. If you haven't been QSLing as much as you'd like to because of the cost of cards, do you really have an excuse anymore? Get some cards and help improve the image of U.S. Amateurs.

☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐ *ORDER BLANK* ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Name______________________________Call______________

(First and last name is most friendly)

Address____

(as brief as possible and still get through the mail)

Style
A ☐
B ☐

City_______________State_____ZIP_______County__________

(a must) (if desired on the card)

Awards to be listed on card ______________________________

(if desired)

☐ **250** ☐ **500** ☐ **1000** ☐ **2000** cards

Foreign Orders: Add following amounts for shipping and handling. (Parcel Post)

250 — $1.75
500 — $2.25
1000 — $4.00
2000 — $6.25

Amount enclosed $__________

Check local Post Office for air rates . .

A product of 73 Magazine, Peterborough NH

Bill Hoisington K1CLL
c/o 73 Magazine
Peterborough NH 03458

A Real Hot Front End for Six...

This describes an excellent front-end circuit for a six meter receiver using microminiature transistors. It is intended to be a companion unit for a transmitter using the same devices, the GE D26G-1, which is a 2N918 chip in a tiny plastic case with a volume of less than 1/16th inch cube.

The design of a complete rig may be taken up later, as it is a complicated affair with many choices such as a pocket set, helmet set, camera-case job, etc. Batteries are involved in such packaging, but this is not too bad a problem with the power requirements of microtransistors. Also to be considered are case size and disposition of tuning and switching knobs, speaker or phones, mic, antenna and cost.

I'm intrigued by cigarette pack-size rigs, Dick Tracy jobs, etc., but my common sense will probably call for a small camera-case type. You've got it on a strap over your shoulder, the battery is inside, you can tune the "dial," the antenna can stick out over your left shoulder, etc. So, later on for all that, and we take up here the basic circuit using small components, describing the rf, mixer, and oscillator – always the main key to a receiver – and a tunable module 1¼ in. square by ½ in. thick.

As an example of what can be done today at a reasonable cost with microtransistors, Fig. 1 shows a schematic and Fig. 2 the layout of an oscillator module. This particular unit is a tunable local oscillator, at present padded from 51 to 55 MHz, for use with a 1.65 MHz i-f. Pushing the power up a little, it will put out 15 to 20 mW of rf as a test transmitter. This bandspread will probably be adjusted later to cover 51.5 to 53.5 as an L.O. for 50 to 52 MHz signals.

Looking at this unit you see at once the outsize components which are the tuning capacitor and, to a lesser extent, the inductance. I have a possibility of a microcoil for around a dollar, of which more later. The Johnson type "U" 14 plate variable capacitor does for the moment. It came with a 3/32 in. shaft, which was adapted to a ¼ in. shaft. Anyone knowing of a smaller suitable unit please let me know. A ¼ in. brass shaft was drilled out for the 3/32 in. shaft and the end slotted with a jeweller's saw, and soldered. Depending on how many additional modules you use, and the exact final packaging shape, you can use a bigger or smaller knob and dial pointer.

At any rate, this oscillator module is right now only ½ in. high by 1¼ in. square, and can serve as a starting point for a tunable pocket-size 6 meter rig. You will

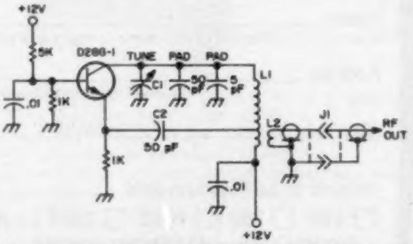


Fig. 1. Small oscillator module schematic. L1=9 turns No. 26 tapped at 1 turn from the low end and wound on a 1/8 in. impregnated form. L2=1 turn or 2 turns for more output. C1=14 plate Johnson type "U."

probably be safe in planning for each stage to be no larger than this little plank, as it has a functioning microtransistor, an inductance, a tuning capacitor, dc bias resistors, bypass capacitors, and padding capacitors. The device at present is the GE microtransistor D26G-1, with the usual Allen-Bradley 1/10th watt 5K and 1K resistors in the base circuit, bypassed with a .01 "Slimcap" by Mucon, made by the Republic Electronics Corp., Paterson, N.J. They are really small, being only 60 mils O.D., but they do work!

The emitter has a 500Ω 1/10th watter, which may go to 1000Ω later because this unit is drawing about 7 mA at present, which is more than needed. During tuneup it was found that this is related to the position of the emitter feedback tap, which should be carefully adjusted so that it will not be too far up on L1 of Fig. 1. If this tap is placed up several turns on L1, there will be too much feedback and the current will be higher than needed. The final circuit shows one turn only. Check this point if you're in doubt.

A 50 pF capacitor from the emitter to the tap on L1 establishes the proper positive feedback, which is in phase with the collector. This makes the base out of phase with the collector, a necessary condition for oscillation.

L1 has 7 turns of No. 26 ssc, closewound on a 1/8 in. form, with a tap at 1 turn. This produces a bandspread of about 4 MHz when using the parallel pad of C2, which is 55 pF in this unit. Naturally a different tuning capacitor for tuning may necessitate a change in L1 and C2 also. For more bandspread (less tuning range) go down on L1's inductance and up on C2's capacity. Do not use over 75 pF however, for a 6 meter L.O., as power will begin to drop, unless you use a bigger device and really need more padding.

Another component which is still "huge" is the rf output jack. The one shown is the smallest phono jack I know of, made by Teletronics, Yonkers, N.Y. Of course if you build the modules all together you can use the short open end of the small coax cable such as 50Ω RG-174/U to hold the open end of the pickup loop L2.

The device itself is mounted on three .021 pins, as described in the first part of this series, which also serve to hold most of the other components too as you can see in the layout, Fig. 2.

L1 started out with about 10 turns, and some padding, and ended up with C2 being a 50 pF and a 5 pF in parallel. These little 60 mil cylindrical capacitors are not given away I might add; they run to around $1 per capacitor, so please remember that I already have mentioned a rising cost with decreasing size.

I hope this completed and working module will give you some ideas of how to plan for a pocket rig. It's doing just that for me right now.

The Local Oscillator

A natural thing to do when building a local oscillator to tune from 50 to 52 MHz signals, is to put in what looks like a high Q coil, and then bring it to the desired frequency with a small tuning capacitor. In the case of 50 MHz L.O. this capacity may be very small in order to spread the 2, or 4 MHz desired over some 90 degrees of the dial. The results of the above procedure can be undesirable, as follows: (a) High harmonic content with consequent increased risk of harmonic detection. (b)

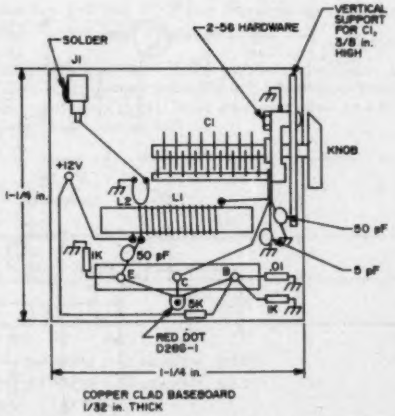


Fig. 2. Layout of the oscillator module. Note that L2 is over the cold end of L1.

Instability, where minute changes in circuit or device capacity can result in large and unwanted frequency changes. (c) Difficult padding and trimming due to the need for very small adjustments.

If, on the contrary, you start in with the idea of using maximum C, you will be much better off, so let's see how much can be used. A trial was made with an air-wound high Q coil, 7 turns of 5/8 in. O.D., 10 turns per inch. It worked fine, but hit 50 MHz with a small C, not allowing enough bandspread. A second coil had 6 turns of bare tinned No. 20, 7/16th in. long, tapped at one turn. Much better, very stable, uses about 75 pF of padding, but which, with the 20 pF variable chosen for tuning, covers only 1.5 MHz, which is not enough tuning range. The range is easily extended though by using a slightly larger coil. Checking on the maximum capacity that could be used and still have a good oscillator, one turn and then 2 turns were chopped off L1, at which time the rf power started to drop off, which indicates that between 75 and 100 pF is about it for this device and the dc power allocated to it for 6 meters. You could design a higher C oscillator if you had to, but in this case we're only looking for a good, general purpose L.O., not an extreme maximum C job.

Going to a 6 turn coil for L1, slightly closer wound, we find about 60 pF for 50 MHz, total capacity, and 2.5 tuning range with a 20 pF tuning capacity for C1. It is now a very good stable oscillator, with smooth power control and current adjustment with R1, so this looks like what we're after.

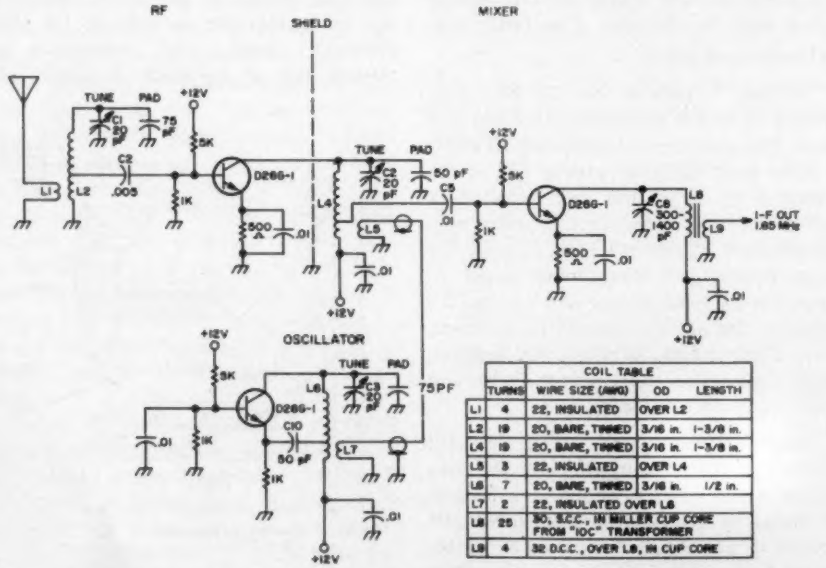
The choice of a 20 pF tuning capacitor was not just an arbitrary one. It is also the range of the Miller three-gang variable capacitor which may be used later.

Various values were tried for C10, of Fig. 3, the emitter feedback capacitor, and from 1000 pF down to near 40 the power increased and then dropped out below 25. A 50 pF was found to be best, and was installed at that point.

The final circuit is shown in Fig. 3, and the breadboard test layout in Fig. 4.

The Front End

At first, nothing seemed right with the exception of the oscillator and even that was undercoupled. This is far from an unusual thing though, with new rigs. You



	COIL TABLE			
	TURNS	WIRE SIZE (AWG)	OD	LENGTH
L1	4	22, INSULATED	OVER L2	
L2	19	20, BARE, TINNED	3/16 in.	1-3/8 in.
L4	19	20, BARE, TINNED	3/16 in.	1-3/8 in.
L5	3	22, INSULATED	OVER L4	
L6	7	20, BARE, TINNED	3/16 in.	1/2 in.
L7	2	22, INSULATED OVER L6		
L8	25	30, S.C.C., IN MILLER CUP CORE FROM "IOC" TRANSFORMER		
L9	4	32 D.C.C., OVER L8, IN CUP CORE		

Fig. 3. Complete schematic for six meter front end using microtransistors (GE D26G-1).

NEW CODE SYSTEM

Now you can learn the code in a fraction of the time it used to take!

73 CODE • COURSE
5 WPM

four speeds available

Plays on any cassette player so you can practice anywhere anytime!

☐ **5 WPM** This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people — including kids of ten — are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

☐ **14 WPM** Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test you'll thank heavens you had this back breaking tape.

A Great Present

Code tapes make a great Christmas present — what else could you give that will provide a life-long skill? When you know the code you stand just a little bit taller than everyone else.

☐ **6 WPM** This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly — under pressure — faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five. Practice this one during lunch, while in the car, anywhere and you'll be more than prepared for the easy FCC exam.

☐ **21 WPM** Code is what gets you when you go for the Extra Class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape. No one who can copy these tapes can possibly fail the FCC test. Remove all fear of the code forever with these tapes.

ONLY $3.95! 73 is in the publishing business, not tapes, so these are priced much lower than anyone else could sell them. Have you ever seen one hour cassettes for under $6?

ORDER NOW!

Name ______________________ Call ______________

Address ______________________________________

City ______________ State ____________ Zip ____________

☐ 5 WPM 1 hr cassette $3.95 ☐ 14 WPM 1 hr cassette $3.95
☐ 6 WPM 1 hr cassette $3.95 ☐ 21 WPM 1 hr cassette $3.95
☐ all four cassettes $13.95

73 Magazine — Peterborough NH — 03458

take some new devices (new to you anyway) and hook them up to coils and other components in a circuit that worked well (on another band) and what happens? Zilch is what happens!

At this time go get a new cup of coffee and install a good signal in the band, not too weak, but not overloading either, and prepare for some hours or days of hard work. See also information in the rf stage section for details of a useful signal generator setup for this sort of work.

Points needing improvement were as follows, referring to Fig. 3. The oscillator was close to the frequencies needed, but proved to be undercoupled to the mixer base circuit. The mixer was undercoupled to the rf collector coil L4 with C5 being too small, and its emitter resistor was too large and L4 was too small, needing almost 100 pF to hit 50 MHz.

Also, the rf stage was far from its best, with L2 being too small, likewise C2, and the base was undercoupled to the input coil L2. The antenna was also too loosely coupled, and even the rf collector tap was too far down on L4. You might think it's a wonder that I heard anything at all with it, and you'd be exactly right. I didn't!

With the signal generator hooked up, some of the more glaring deficiencies were corrected and things began to perk up. Finally, with action showing in the mixer tuning, the usual gang on Six down in Massachusetts started booming in after breakfast, and the little microminiature specks began to shape up. Most of the low sensitivity seemed due to the low value of inductance I had put in and the small base coupling capacitors.

Don't forget, I was only running a single i-f stage with the front end, and this counts for a lot because every time I put the 1.65 MHz output into the lab receiver things sounded very powerful. This is a common fault when building converters. One tends to neglect absolute sensitivity (overall power gain) when using a high-power i-f. The single stage i-f on 1.65 MHz really makes you peak things up in the converter, with the result that you have a lively, matched, selective unit.

One of the items neglected when I first set up the converter was the fact that on ten meters I had been using a ten turn coil, but it had a powdered iron core inside and out which greatly increased the inductance. So, on Six, I pruned L2 and L4 carefully, for gain and selectivity, still keeping the highest possible C for padding in order to get the needed bandspread, and suppression of harmonic detection and birdies.

The Mixer Circuit

Referring again to Fig. 3, the collector output coil tuned to 1.65 MHz by C8 is a more or less standard coil and worked right away. Miller 9054 coils will do all right also at this point.

The emitter was securely bypassed to ground to prevent the mixer from taking off as an oscillator (it didn't), which can happen with a tuned collector, a partially open (not tied to ground) emitter, and base tightly coupled to ground at 1.65 MHz through a small link or tap at 50 MHz.

Table 1. Mixer base tap on L4 using a 9-turn coil, 5/8 in. diameter, for L4.

Tap Turns From Low End	Relative Volts
2	10
3	19
4	17
5	17
6	14

Table 2. Capacity to rf base (C2 of Fig. 3).

pF	Relative Volts
100	10
1,000	18½
5,000	19

Table 3. RF base tap using 19 turn coil as L2 in Fig. 3.

Number of Turns From Ground	Relative Volts
3	22
4	26
6	25
9	20

Table 4. Number of turns in antenna link coil L1 of Fig. 3.

Number of Turns L1	Relative Volts
2	20 (some oscillation in RP stage)
3	23
4	24½ (very stable)

Best emitter bias resistor was found to be 500Ω for the microtransistor D26G-1, with 5K and 1K supplying the base bias as usual. Voltages to ground while operating were as follows; collector 10½V, emitter 1.6V, and the base 2V.

A new L4 was installed, with the small diameter coil, 1/8 in. I.D., bare tinned No. 20, 1 3/8 in. long, with results as in Table 1. The parallel pad for L4 was now about 45 pF, which was a good value to start with. The tuning was sharp and clean, with no spurious or birdies, and already at 6:45 A.M. the mobile lads on Six were coming in from 60 miles away as I tuned up and down while checking the bandspread. That's one way to tune up a mixer and make it really work.

Tuning Up the RF Stage

The signal used for this work (and the mixer also) was my faithful old signal generator, with a piece of wire 4 ft long, horizontal, attached to the "High" output, and tuned to 50.2 MHz.

This was placed about 75 ft away, indoors (houses are large in N.H.), and with the 4 element six meter beam used on the front end for tests, pointed about 3/4 away from the generator. Be sure and check that the signal *is* coming in via the beam, otherwise you may falsify the results. As the rf stage input is one of the more difficult points, I always like to use the beam and 50Ω cable for a life-like test. With the above setup the dc signal out of the single i-f stage diode was about 1/10th of a volt, which is enough to tabulate gain with and yet not enough to overload any of the circuits.

The rf collector tap (see Fig. 3) was found to be best at the high end of L4, due no doubt to the relatively low impedance resulting from the high parallel capacity C4A and C4B. The rf base capacity was found to be best at a high value, the same as the mixer. Table 2 shows the trend.

Table 3 demonstrates the influence of the rf base tap on the tuned input coil L2. It is interesting to note the similarity of the mixer base and the rf base as far as matching impedance on tuned circuits. RCA in their detailed and well worked out application circuits section also attach considerable importance to this ratio of the base tap section of the coil to the remainder, so we're in good company.

Voltages while operating were as follows: collector 10.5, base 1.6, emitter 1.0 volt, relative to ground.

The 50Ω antenna cable was tapped at 2 and 3 turns, with a drop noticed at 1 turn, and some self-oscillation due to the light loading. With 4 turns of link coupling it

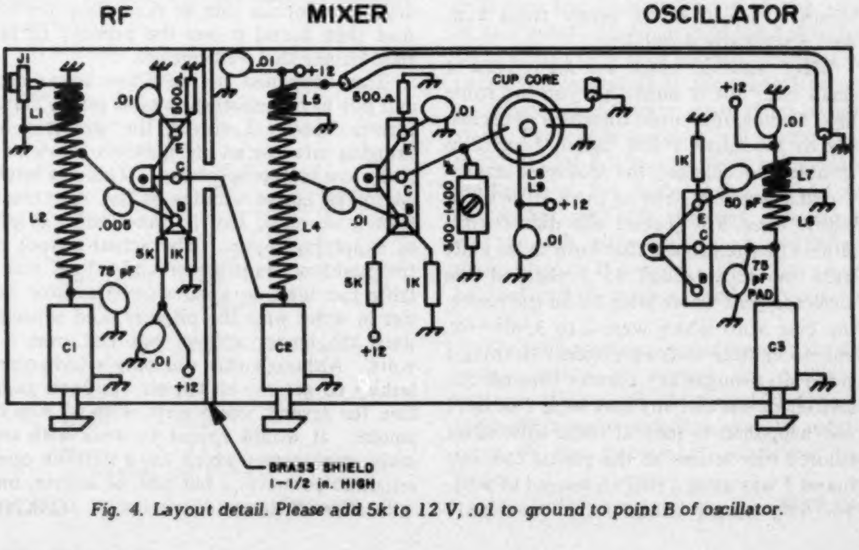


Fig. 4. Layout detail. Please add 5k to 12 V, .01 to ground to point B of oscillator.

was very stable and tuned well as shown in Table 4. This is always nice because it takes up little space, is easily adjusted, and doesn't cost anything. You also avoid more trimmers, which are quite large compared to the transistors being used. You have to be sure it's working though. You don't always get the best match with such a link.

A final trim-up of the oscillator input link L5 placed its three turns of L4 from ground for the best sensitivity.

The lab receiver was then connected for a check, tuned to 1.65 MHz as an i-f and plugged into the mixer output. Absolutely everything on the band could be heard and separated in fine style.

Results

After all the pruning and peaking up shown in Tables 1 through 4, plus other little things, I now have one of the best and most economical receivers for Six I've ever used. Still running the single i-f stage on 1.65 MHz I can hear anything that moves on the band. There are some very small coils suitable for 1.65 i-f and filter work, but more on that later. The rf input tuning is particularly nice peaking right up on frequency with good symmetry in the resonant tuning curve. I still find something definitely advantageous and different about those little GE gems as compared to the larger transistors used in the past.

At any rate, you have here a good sensitive, selective, six meter front end, with pocket size possibility.

Have another laugh on me . . . just a small one, but it might hit you too some day. Tuning up a single transistor af oscillator to modulate a test signal, I ran into trouble and changed the Motorola transistor that was in it, one of those little black plastic ones. The second one didn't work either (I hasten to say that both those units were perfectly good) so I checked the collector volts which were 12 on the meter, the base volts which were 2 to 3, also ok, but no emitter volts or current! Nothing I could do brought any current through the emitter or showed any bias volts. Finally, I just happened to look at those little silver colored tiny letters on the plastic case and found I was using a HEP56 instead of a 55. The 55's are my choice for a "Universal" device, and I've put nearly 4 dozen of them into circuits in the last several months and they all worked well. Figures 5A and B show what was happening. I had been applying dc bias to the emitter instead of the base. So keep your eyes open and maybe it won't happen to you.

This six meter front end using microminiature transistors in a breadboard circuit with all small components and their best values determined, and working like a charm, is now ready for packaging, but small!

It is intended that two stages of 1.65 MHz i–f, with avc, will be tuned up using these little devices also, and packaged to match in size. As you can see by the module example, one stage including the variable capacity has been packaged ½ in. thick by 1¼ in. square, not counting the tuning knob. This indicates a possible pocket rig some 1½ in. high, 1½ in. wide, and 4 in. long. Battery, mic, speaker, and antenna yet to come. This is using 4 stages in the transmitter and about 8 in the receiver. Maybe it will take an overcoat pocket just now, but at least you can see where we're heading.

. . . K1CLL

AN EMERGENCY TRANSFORMER

How many times have you discovered a dead transformer just as sked time neared? And then found it was the primary of the transformer that had opened.

This happened to me a few weeks ago, and not having another suitable power transformer handy, I solved the problem by bringing into use an old junkbox job with a hefty low voltage secondary. This was hitched to the heater winding of the main transformer – and so fed the tubes direct as well as supplying B-plus. The actual output of the junkbox transformer under load was a trifle too high, so a wirewound resistor was put in series with the primary, and adjusted until the heater voltage was just over 6.3 volts. Although this was only a temporary lashup to get me on the air, it's been going fine for several weeks now, with no sign of smoke. It would appear to work with any main transformer which has a definite open circuited primary – but not, of course, one with shorted turns.

. . . G3KPO

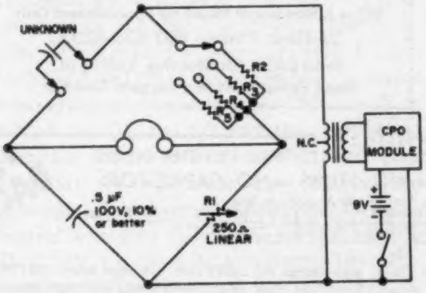
BUILD A BASIC BRIDGE

William P. Turner WA0ABI
5 Chestnut Court
Saint Peters MO 63376

Occasionally the Novice or casual amateur requires the use of a capacitor checker while in the process of building or repairing his equipment. The frequency of this need is often such that the purchase of a kit or commercial checker could not be justified. Over the years many homebrew models have been presented in the various electronic magazines, but these are apt to be too expensive or too complicated to fill the need.

Presented here is a cheap, easy to construct checker which will measure capacitors from .0001 to 1.0 μF in four ranges with about as much accuracy as the builder might desire. While not covering a wide range of capacitance, it will check 90% or more of the capacitors found around the shack. The normal "entertainment" grade resistors, capacitor and poteniometer will do nicely . . . on the other hand, accuracy may be greatly increased if precision components are used and precision calibration undertaken.

The basic circuit is a bridge, one leg being a switch selected range resistor, the second a 250Ω variable element, the third leg a .5μF "standard" capacitor, and the fourth, the unknown. When the ratio of the unknown to the standard equals the ratio of R1 to R2, R3, R4, or R5, the bridge is in balance and no audio output appears across the null detector terminals.



RESISTOR	SCALE
R2 - 100K	X 100 pF
R3 - 10K	X 1000 pF
R4 - 1K	X .01 μF
R5 - 100Ω	X .1 μF

ALL RESISTORS - 1/2W, 5% or better

Fig. 1. Transformer shown is 500ct:8Ω.

The bridge is supplied with audio voltage by a packaged "code practice oscillator" module (in this case a Cordover CPO-4) of the 98¢ variety fed through a 79¢ transistor output transformer running backwards for impedance matching purposes. A similar homebrew oscillator could be used if desired. The null detector may be as simple or complicated as you have available. A pair of earphones, an amplifier, an ac VTVM, or a scope are usable. Phones are quite satisfactory and have the advantage of being readily available in the average shack.

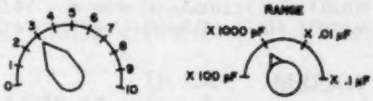


Fig. 2. Suggested method of calibration.

Calibration consists of nulling the bridge with a known value capacitor across the unknown terminals and marking the scale at that point. Continue until the 1 through 10 positions have been located, changing or paralleling capacitors as necessary. It is not necessary to calibrate each range separately. The range resistors will insure that the scales are not too far from being exact multiples of the basic range. It will be noted that with the specified potentiometer the scale will cover only about 180° of shaft rotation. If desired, a 150Ω pot could be used and the scale expanded to cover a full 270°.

The unit as originally constructed used a rotary switch to control the oscillator battery. If you are the forgetful type, a normally open pushbutton may be substituted in the interest of conserving the battery.

. . .WA0ABI

NASEM

COMMUNICATIONS INTEGRATED CIRCUITS

IC TYPE	DESCRIPTION	CASE	Price,Ea.
NA555	Versatile Timer	8-DIP	0.99
NA555-2	Dual Timer	16-DIP	1.55
NA370	AGC/Squelch/VOX	10-TO5	1.20
NA371	Versatile rf/i-f	10-TO5	1.29
NA3018	4-Trans. Array	12-TO5	0.89
NA3026	Dual Diff. Array	12-TO5	0.99
NA3086	5-Trans. Array	14-DIP	0.45
NA3036	Dual Darlington	10-TO5	0.75
NA1595	Analog Multiplier	14-DIP	1.90
NA8038	VCO/Sine/Sq./Tri.	14-DIP	4.50
NA1596	Bal. Mixer/Mod.	10-TO5	1.20
NA376	Voltage reg., pos. low stdby.	8-DIP	1.25
NA723	Voltage reg., pos/neg.	10-TO5	0.99
NA741	Op. amp.	8-DIP	0.45
NA1303	Stereo preamp	14-DIP	0.99
NA1304	Stereo multiplex decoder	14-DIP	1.20
NA2111	FM i-f strip/quad. detector	14-DIP	2.25
NA3075	FM i-f strip/det/preamp	14-DIP	2.45

NASEM *Box AI*
Cupertino CA 95014

- *24 Hour COD—Phone Answering Service*
- *Our Data/Application Sheet Enclosed with Each Type Shipped*
- *Every Unit 100% Parameter and Function Tested to our Guaranteed Limits on the same FAIRCHILD Computer-Type High Speed Tested Used by Major Semi Companies*

——RADIO TRANSMITTER ON A CHIP !——

NA2000 100mW AM on 20 Meters $9.95
NA2001 250mW AM on 10 Meters $14.95

Both types usable at reduced output at 6 Meters and above. Requires external crystal & 2 tuned circuits. With data/applications.

——SPECIAL – TRANSISTOR BAGS——

2NA2222	NPN Trans., bag of 12	TO18	2.00
2NA2907	PNP Trans., bag of 12	TO18	2.00
2NA3904	NPN Trans. Plastic, bag/20	TO92	3.00
2NA3906	PNP Trans. Plastic, bag/20	TO92	3.00

TERMS

Prepaid U.S. orders over $10.00, we ship.
Prepaid U.S. orders under $10.00, add $1.00.
Prepaid foreign orders over $10.00, add postage.
Prepaid foreign under $10.00, add $1.00 plus postage.
COD U.S. orders over $10.00, add $1.50.
COD U.S. orders under $10.00, add $2.50.
No Foreign COD orders.
California residents add 6% sales tax.

COD PHONE (408) 867–5900

Automatic recorded 24 hour COD telephone order service — supply full information concerning order and shipping instructions. Requested return calls — Collect only . . .

ANTENNAS

Beams – Doublets – Quads – Verticals – Cable & Towers –
HyGain – Newtronics – Mosley – Cushcraft – Mini Products – Antenna Specialists *– and more --*

FRECK RADIO & SUPPLY CO. Inc.
P.O. Box 7287 W4WL
Asheville NC 28801
704-154-9551
Est. 1921

BANKAMERICARD

C F P ENTERPRISES
866 RIDGE ROAD, LANSING, N. Y. 14882

Whether you extend the range of your VHF FM station with the new Ringo Ranger or rotate your house with full size HF Monobeam, it's hard to beat **CUSHCRAFT** for the very best in antennas.

Contact CFP today for the Cushcraft antenna of your choice. You'll be glad you did.

Office & Salesroom Hours by Appointment Only
24-Hour Phone: 607-533-4297
Send SASE for Monthly Listing of Used Equipment and Bargain Goodies

MORGAIN

NOW IS BACK

EXCLUSIVE 66 FOOT 75 THRU 10 METER DIPOLE
NO TRAPS – NO COILS – NO STUBS – NO CAPACITORS
Fully Air Tested – Thousands Already in Use

#16 40% Copper Weld wire annealed so it handles like soft Copper wire—Rated for better than full legal power AM/CW or SSB-Coaxial or Balanced 50 to 75 ohm feed line—VSWR under 1.5 to 1 at most heights—Stainless Steel hardware—Drop Proof Insulators—Terrific Performance—No coils or traps to break down or change under weather conditions—Completely Assembled ready to put up—Guaranteed 1 year—ONE DESIGN DOES IT ALL: 75-10HD—ONLY $12.00 A PAND!

Model 75-10HD	$60.00	66 Ft	75 Thru 10 Meters
Model 75-20HD	$50.00	66 Ft	75 Thru 20 Meters
Model 75-40HD	$40.00	66 Ft	75 Thru 40 Meters
Model 40-20HD	$33.00	35 Ft	40 Thru 20 Meters
Model 80-40HD	$42.00	69 Ft	80-40-15 Meter (CW)

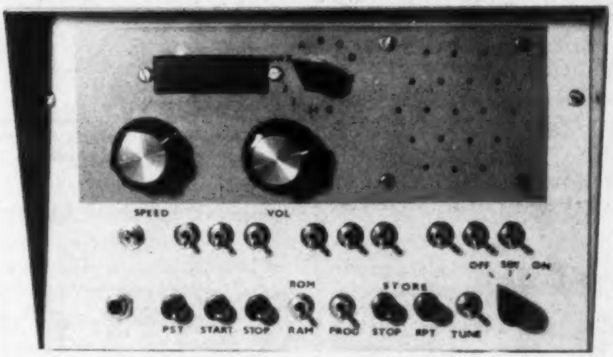
ORDER DIRECT OR WRITE FOR FULL INFORMATION

MORGAIN

300 S. Shawnee
Leavenworth, Kansas 66048

OR THRU YOUR FAVORITE DISTRIBUTOR

Emil Hrivnak W3HPX ex-W1GCA
147 Penn Lear Drive
Monroeville PA 15146



MOSKEY

A PROGRAMMABLE IAMIC CMOS KEYER

Part 3

The concluding part of this series covers the remaining functions such as the sidetone, transmitter keyer, power supply, and others necessary to complete the keyer.

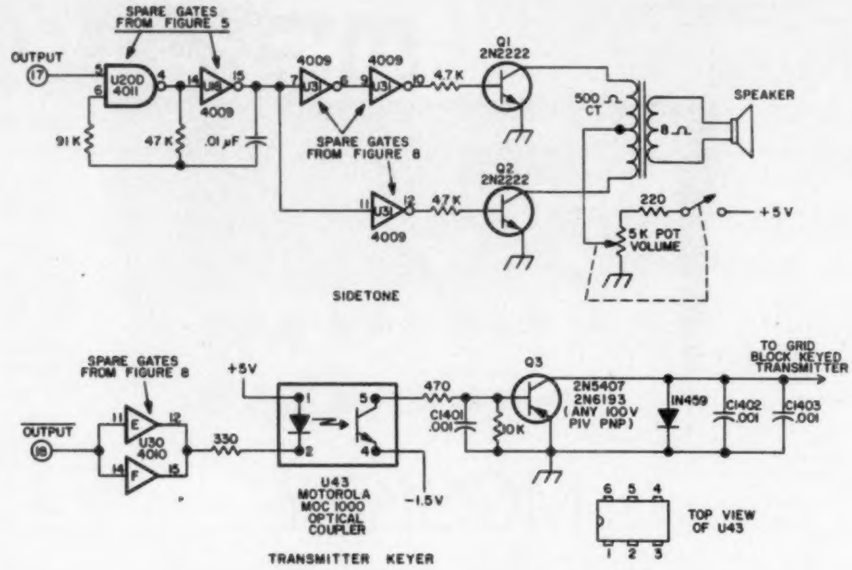
Sidetone

Fig. 14, is the schematic of the sidetone oscillator and buffer to drive the speaker. The spare gates from Fig. 5, and from Fig. 8, are used in the sidetone circuit. The oscillator is adjusted for approximately 1 kHz. Each time OUTPUT goes high the oscillator is turned on. I originally used CMOS buffers instead of Q1 and Q2 and the circuit had adequate volume but no reserve. Now there is plenty of drive for the speaker and although I haven't tried it, the volume control could be connected to the unregulated 16V for even more output. Any NPN transistor from your junk box should work for Q1 and Q2.

Transmitter Keyer

I currently have a Heath SB-101 transceiver which uses grid block keying, keying about -60V at 1 to 2 mA to ground. I decided to use an optical coupler to interface with the transmitter. (An optical coupler has a LED and a photo transistor in it. When current flows through the LED, it emits light. The light striking the base region of the photo transistor causes the transistor to turn on.) Since the voltage rating of the optical coupler transistor is only 30V, I use it to drive a high voltage PNP transistor for keying the transmitter. The circuit provides about 1 mA of base drive to the keying transistor, Q3. I used a D cell flashlight battery to provide the negative voltage for turning on Q3. A negative voltage could be generated from the ac power supply, but I decided that I may want to operate the keyer from an external battery some day for portable operation and then it would have required two external batteries. Only 1 mA is drawn from the flashlight battery during key down conditions and the battery should last for shelf life.

A small amount of rf interference was noted the first time the keyer was connected to the transmitter. C1401 cured all of the problems but I added a few extra for


SPARE GATES FROM FIGURE 5
OUTPUT
17
U200 4011
4009
U18
4009
U31
4009
U31
SPARE GATES FROM FIGURE 8
91K
47K
.01 μF
Q1 2N2222
Q2 2N2222
47K
47K
4009
500 Ω CT
8 Ω
SPEAKER
220
+5V
5K POT VOLUME
SPARE GATES FROM FIGURE 8
+5V
OUTPUT
18
E
F
U30 4010
330
470
U43 MOTOROLA MOC 1000 OPTICAL COUPLER
-1.5V
C1401 .001
10K
Q3
2N5407 2N6193 (ANY 100V PIV PNP)
IN459
C1402 .001
C1403 .001
TO GRID BLOCK KEYED TRANSMITTER
TOP VIEW OF U43

SIDETONE

TRANSMITTER KEYER

Fig. 14. Sidetone and transmitter keyer.

insurance. Install C1402 near Q3 and install C1403 at the panel jack that goes to the transmitter. I have found when digital circuits are operated near high power transmitter a handful of bypass capacitors installed on input/output lines is always worth the time and effort.

Other methods of keying the transmitter could be incorporated such as a reed relay, NPN transistor or whatever you desire. Gates U30 E and F, connected as a pair, are capable of sinking about 8 to 10 mA to ground, or sourcing 1.5 to 2 mA of current. If you decide to drive a relay use a buffer transistor.

Display

A four digit display (see Fig. 15) is used in the keyer and the numbers are displayed in octal or base 8 format. The first 3 address lines go to the units display. Address lines 4, 5 and 6 go to the tens display. Address lines 7, 8, and 9 go to the hundreds display and address line 10 goes to the thousands display. As the address counter counts up from zero, the address lines will advance in a binary mode. The units display will count from 0 to 7. The next count is 8, with address line 4 high and 1 through 3 low. Line 4 makes the tens display read 1 and lines 1, 2, and 3 make the units display read 0. So we see 10 not 8 on the display. If you haven't worked with octal numbers before it may seem confusing at first, but it is a very convenient way of handling binary numbers. There are 1024 locations in memory or 0 to 1023 decimal. The display will read from 0 to 1777. Don't even try to convert back to decimal when jotting down a starting address from the display. If the display reads 1356, write down 1356. If you group the address selection switches in groups of 3 with a little

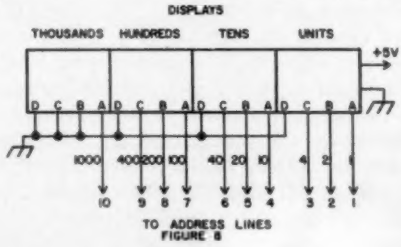
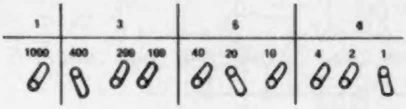

DISPLAYS
THOUSANDS
HUNDREDS
TENS
UNITS
+5V
D C B A
D C B A
D C B A
D C B A
1000
400 200 100
40 20 10
4 2 1
10
9 8 7
6 5 4
3 2 1
TO ADDRESS LINES FIGURE 8

Fig. 15. Display wiring.

separation between groups, each group of three is an octal digit. To obtain 1356 set the switches to:



The buffers on the address lines can drive about 3 TTL loads. Even with both PROMS installed that leaves enough drive for the displays. Any display, seven segment incandescent, LED (light emitting diode), or nixie type can be used with its appropriate decoder/driver provided the decoder/driver has TTL compatible inputs. There are many of these currently available on the market. Ten individual light bulbs could also be used provided some sort of transistor driver is incorporated. I use seven segment incandescent displays in my keyer.

Address Selection Switches

Fig. 16, shows two options for wiring the address selection switches. Fig. 16a, is the simplest way and just requires 10 switches. Space them in 3 groups of 3 and a single one as mentioned before. Having seven sequences programmed in PROM I decided it would be nice to have a single rotary switch to select any one of the seven starting locations. Fig. 16b, shows how this was done. You must first decide on what you are going to program in PROM to determine the needed starting locations. Then you can set up the diode matrix for those locations.

CMOS-TTL Compatability

CMOS logic can be operated over a voltage range of 3 to 15V, unlike TTL which is 5V ±5% for commercial temperature range. The memories I have selected operate at 5V and since the PROM is a TTL device, the entire keyer is operated at 5V. TTL devices can be used in CMOS circuits provided a pull-up resistor is used on the output of any TTL device driving a CMOS device. This insures that logic 1 output levels are approximately 5V instead of only 3.3V, typically, which is adequate for a TTL logic 1 level. CMOS gate outputs switch logic levels when the input passes through a voltage level equal to approximately 45% to

GATEWAY
ELECTRONICS
8123-25 PAGE BOULEVARD
ST. LOUIS, MISSOURI 63130
(314) 427-6116

THUMBWHEEL SWITCHES

STANDARD SIZE - 0.5 x 2.125 x 1.78
10 position decimal $3.00
10 position BCD & compl. $4.00
End Plates (per pair) $1.45

MINIATURE SIZE - 0.312 x 1.3 x 1.3
10 position decimal $2.50
10 pos. BCD & comp. $4.00
10 pos. BCD only $2.75
End Plates (per pair) $1.00
Divider Plates $1.25
Blank Body $ .30

All switches are black with white figures and snap-in front mounting.

TRIAC CONTROLLER – Triac adjustable light dimmer rated at 1200 watts – 0-115 volt. Ship. wt. 2 lbs. $3.50

2" SCOPE TUBE SHIELD – Manf. by Millen. Ship. wt. 1 lb. $3.95

PAMONA BOX – 2 1/4 x 1 1/8 x 7/8 Miniature box w/BNC plug & jack – good for attenuators & other small projects. Ship. wt. 1/2 lb. $3.95

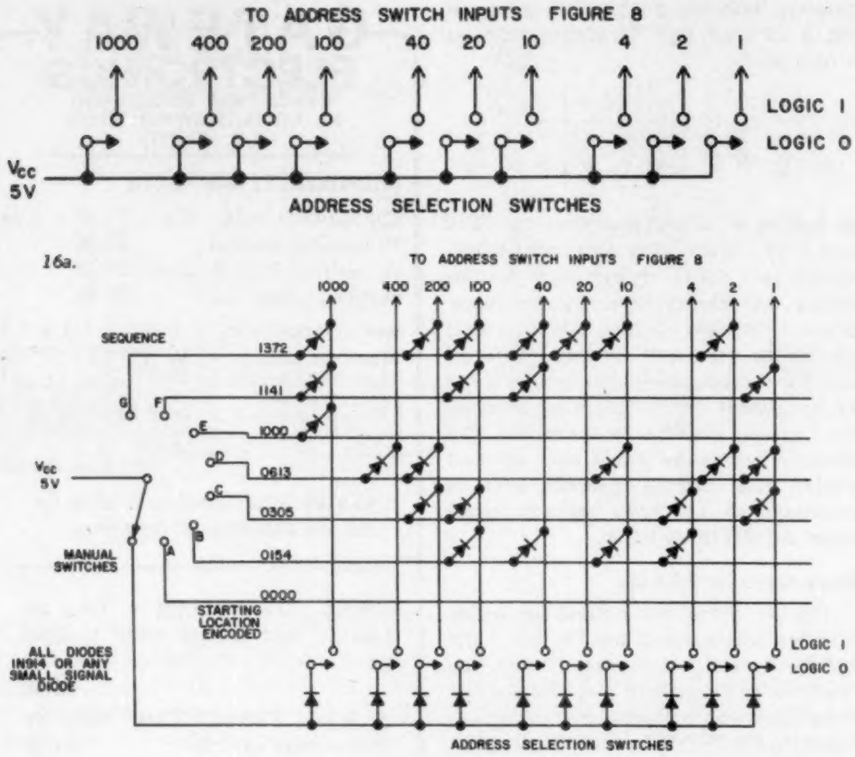
BNC JACK TO BNC PLUG

MINIATURE SWITCHES – DPDT Miniature Push-button switch $1.50

MINIATURE SWITCHES – SP6T Enclosed Miniature rotary SW. ½" dia. $1.50

EQUIPMENT COOLING FAN – 115V AC – 3" diameter – w/mounting bracket – 3 lbs. $3.50

$5 Minimum Order. Visit us when in St. Louis. Please include sufficient postage.


TO ADDRESS SWITCH INPUTS FIGURE 8
1000
400
200
100
40
20
10
4
2
1
LOGIC 1
LOGIC 0
Vcc 5V
ADDRESS SELECTION SWITCHES
SEQUENCE
1372
1141
1000
0613
0305
0154
0000
G
F
E
D
C
B
A
MANUAL SWITCHES
STARTING LOCATION ENCODED
ALL DIODES IN914 OR ANY SMALL SIGNAL DIODE

16a.

16b.

Fig. 16 a and b. Two methods for wiring address selection switches.

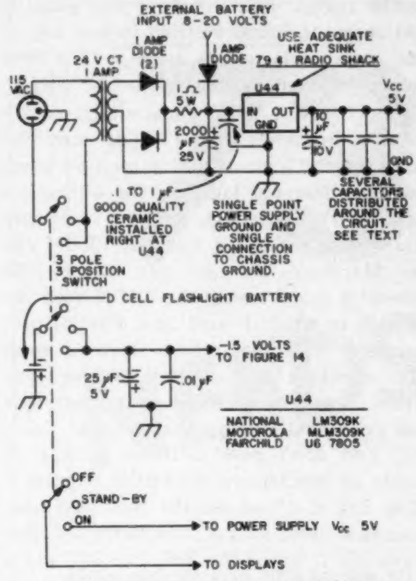
55% of the supply voltage for the CMOS gate, that is a low input should be less than 45% of the supply voltage, and a high input should be greater than 55% of the supply voltage. For safe designs a low input should be less than 30% of the supply voltage or less than 1.5V at a supply of 5V. A high input should be greater than 70% of the supply voltage or greater than 3.5V at a supply of 5V. The pull-up resistors on the output of the memories and the PROMS insure a good logic 1 input to the CMOS multiplexer.

Power Supply

The CMOS logic in the keyer draws about 2 mA. The various pull-up/pull-down resistors draw several mA depending on the position its associated switch is in. The two RAMS draw 30 mA each, and each PROM draws 80 to 100 mA. The sidetone draws about 20 mA at maximum volume. I used seven segment incandescent displays which draw a total of 700 mA. The total current requirements for the keyer is about 1A, but this is largely dependent on the displays used. A switch could be installed in the display power lines to conserve power when operating from battery. The power supply Fig. 17, uses a 24V filament transformer and a three terminal monolithic 5V regulator. This type of supply has appeared many times in current publications.

Construction

The keyer can be fabricated any way the builder desires. I built mine into a 15.24 x 17.7 x 25.4 cm box. Keep leads as short as possible and use a single point ground and a single point 5V connection from the supply. Run a separate ground and 5V line to each


EXTERNAL BATTERY INPUT 8-20 VOLTS
1 AMP DIODE (2)
1 AMP DIODE
USE ADEQUATE HEAT SINK 79¢ RADIO SHACK
24 V CT 1 AMP
115 VAC
1Ω 5W
U44
IN
OUT
GND
V_{cc} 5V
2000 µF 25V
10 µF 10V
GND
.1 TO 1 µF GOOD QUALITY CERAMIC INSTALLED RIGHT AT U44
SINGLE POINT POWER SUPPLY GROUND AND SINGLE CONNECTION TO CHASSIS GROUND.
SEVERAL CAPACITORS DISTRIBUTED AROUND THE CIRCUIT. SEE TEXT
3 POLE 3 POSITION SWITCH
D CELL FLASHLIGHT BATTERY
-1.5 VOLTS TO FIGURE 14
25 µF 5V
.01 µF
U44
NATIONAL LM309K
MOTOROLA MLM309K
FAIRCHILD U6 7805
OFF
STAND-BY
ON
TO POWER SUPPLY V_{cc} 5V
TO DISPLAYS

THE KEYER IS FULLY OPERATIONAL IN STAND-BY POSITION; ONLY THE DISPLAYS ARE TURNED OFF.

Fig. 17. Power supply

card or group of ICs, and run a separate ground and 5V line to whatever displays you choose. Use some .001 µF capacitors as bypasses from 5V to ground on each card or group of ICs. A couple of 10 to 50 µF capacitors sprinkled around will always make digital circuits quieter and never hurt.

If you counted the ICs on the two cards in the photographs you came up with 40. However, the schematic shows 42. CD4035, 4 bit shift registers can be used as quad D flip-flops, and 2 of these could replace 4 CD4013 dual D flip-flops. But since the Q and Q BAR outputs are not both available, other substitutions and rearrangements must be made. Because of the diffiuclty in splitting a complex device, such as the 4035, over several schematics, and the confusion it might create, I decided it was best in the long run to add two chips to simplify things. Also, the sidetone was modified after the pictures were taken, so you won't find Q1 or Q2, either.

PROM Coding

Figure 18 shows the coding in my PROM to call CQ. The sequence programmed is CQ CQ CQ DE W1GCA W1GCA W1GCA (re-

FREE IC

With Every $10 Order*

- REDUCE YOUR PROJECT COSTS
- MONEY-BACK GUARANTEE
- 24-HOUR SHIPMENT
- ALL TESTED AND GUARANTEED

• TRANSISTORS:	
NPN:	
2N3563 TYPE RF Amp & OSC to.1GHz (pl. 2N918)	6/$1.00
2N3565 TYPE Gen. Purpose High Gain (TO-106)	6/$1.00
2N3691 TYPE GP Amp to 25 mA and 50 MHz	6/$1.00
2N3866 TYPE RF Pwr Amp 1-2 W @ 100-600 MHz	$1.50
2N3903 TYPE GP Amp & Sw to 100 mA and 30 MHz	6/$1.00
2N3904 TYPE GP Amp & Sw to 100mA (TO-92)	5/$1.00
2N3919 TYPE RF Pwr Amp 3-5 W @ 3-30 MHz	$3.00
Assort. NPN GP TYPES, 2N3565, 2N3641, etc. (15)	$2.00
PNP:	
2N3638 TYPE Gen. Purpose Amp & Sw	4/$1.00
2N4249 TYPE Low-Noise Audio Amp 1 µA to 50mA	4/$1.00
• FET's:	
N-CHANNEL (LOW-NOISE):	
2N4416 TYPE RF Amplifier to 450 MHz (TO-72)	2/$1.00
2N5486 TYPE RF Amp to 450 MHz (plastic 2N4416)	3/$1.00
2N5163 TYPE Gen. Purpose Amp & Sw (TO-106)	3/$1.00
2N4091 TYPE RF Amp & Switch (TO-106)	3/$1.00
ITE4868 TYPE Ultra-Low Noise Audio Amp.	2/$1.00
Assort. RF & GP FET's, 2N5163, 2N5486, etc. (8)	$2.00
P-CHANNEL	
2N4360 TYPE Gen. Purpose Amp & Sw (TO-106)	3/$1.00
M104 TYPE MOS FET (Diode protected) 0.3 pF	$3.00
• LINEAR IC's:	
555X Timer 1 µs-1 hr, Dif. pinout from 555 (DIP)	$ .90
709 Popular OP AMP (DIP/TO-5)	$ .39
723 Voltage Regulator 3-30 V @ 1-250mA (DIP/TO-5)	$ .75
739 Dual Low-Noise Audio Preamp/OP AMP (DIP)	$1.00
741 Freq. Compensated OP AMP (DIP/TO-5/MINIDIP)	$ .45
2556 Dual 555 Timer 1 µsec to 1 hour (DIP)	$1.55
LM305 Positive Voltage Regulator (TO-5)	$1.25
MC1458 Dual 741 OP AMP (MINI-DIP)	$ .95
Assorted Linears-741/709/723, etc. (4)	$2.00
• DIODES:	
1N914 TYPE Gen. Purpose 100V/10mA	10/$1.00
1N3600 TYPE Hi Speed SW 75V/200mA	6/$1.00
1N4608 TYPE GP & SW 80V/400mA	6/$1.00
1N3893 TYPE RECTIFIER Stud Mount 400 V/12 A	2/$1.00
1N749 ZENER 4.3 Volt 400mW	3/$1.00
1N753 ZENER 6.2 Volt 400mW	4/$1.00
1N755 ZENER 7.5 Volt 400mW	4/$1.00
1N757 ZENER 9.1 Volt 400mW	4/$1.00
1N758 ZENER 10 Volt 400mW	4/$1.00
1N965 ZENER 15 Volt 400mW	4/$1.00
1N968 ZENER 20 Volt 400mW	4/$1.00
D5 VARACTOR 5-50 W Output @ 30-250 MHz, 7-70 pF	$5.00
F7 VARACTOR 1-3 W Output @ 100-500 MHz, 5-30 pF	$1.00

***MAIL NOW!** With every order of $10 or more, postmarked prior to 12/31/74, FREE 739 or 749 Low-Noise Dual OP AMP included—$1 VALUE.

ORDER TODAY—All items subject to prior sale and prices subject to change without notice. DATA SHEETS included with all items.

WRITE FOR FREE CATALOG offering hundreds of semiconductors not listed here. Send 10¢ stamp.

TERMS: All orders prepaid. We pay postage. $1.00 handling charge on orders under $10. Calif. residents add 6% sales tax.

ADVA ELECTRONICS

BOX 4181-K, WOODSIDE, CA 94062
Tel. (415) 851-0455

PROM WORD	OP-CODE BITS				CODE		
	A	B	A	B			
	OUTPUT BITS						
	1	2	3	4			
1	1	0	0	1	–	●	C
2	1	1	1	0	LS	–	
3	1	0	0	1	–	●	
4	1	0	0	0	–	WS	Q
5	1	0	0	1	–	●	
6	1	0	0	1	–	●	C
7	1	1	1	0	LS	–	
8	1	0	0	1	–	●	
9	1	0	0	0	–	WS	Q
10	1	0	0	1	–	●	
11	1	0	0	1	–	●	C
12	1	1	1	0	LS	–	
13	1	0	0	1	–	●	
14	1	0	0	0	–	WS	Q
15	1	0	0	1	–	●	
16	0	1	1	1	●	LS	D
17	0	1	0	0	●	WS	E
18	0	1	1	0	●	–	
19	1	0	1	1	–	LS	W
20	0	1	1	0	●	–	
21	1	0	1	0	–	–	
22	1	0	1	1	–	LS	1
23	1	0	1	0	–	–	
24	0	1	1	1	●	LS	G
25	1	0	0	1	–	●	
26	1	0	0	1	–	●	C
27	1	1	0	1	LS	●	
28	1	0	0	0	–	WS	A
29	0	1	1	0	●	–	
30	1	0	1	1	–	LS	W
31	0	1	1	0	●	–	
32	1	0	1	0	–	–	
33	1	0	1	1	–	LS	1
34	1	0	1	0	–	–	
35	0	1	1	1	●	LS	G
36	1	0	0	1	–	●	
37	1	0	0	1	–	●	C
38	1	1	0	1	LS	●	
39	1	0	0	0	–	WS	A
40	0	1	1	0	●	–	
41	1	0	1	1	–	LS	W
42	0	1	1	0	●	–	
43	1	0	1	0	–	–	
44	1	0	1	1	–	LS	1
45	1	0	1	0	–	–	
46	0	1	1	1	●	LS	G
47	1	0	0	1	–	●	
48	1	0	0	1	–	●	C
49	1	1	0	1	LS	●	
50	1	0	0	0	–	WS	A
51	0	0	1	0	WS	–	Repeat
52	0	1	1	0	●	–	K
53	0	0	1	1	WS	LS	Stop

OP-CODE BIT		
A	B	CHARACTER
0	0	Word Space – WS
1	0	Dash
0	1	Dot
1	1	Letter Space – LS

WS/WS = Repeat

WS/LS = Stop

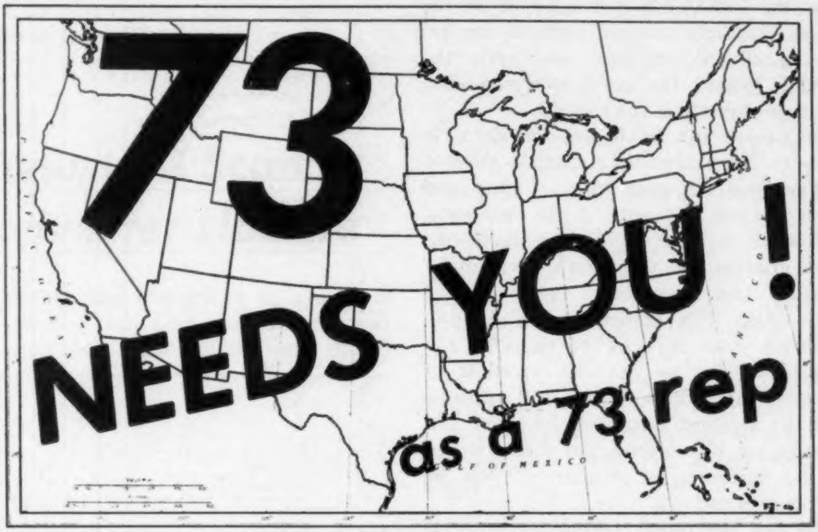
Fig.18. Example of PROM coding to send CQ.

peat)K (stop). This will serve as a guide if you decide to install PROMS in your keyer. The logic levels are the same as they have been all through the discussion of MOSKEY; a high = logic 1 =s5V, a low = logic zero = 0V. Unfortunately some PROM manufacturers use this logic definition on the address lines and inverted logic on the outputs; a logic 1 = 0V, and a logic zero = 5V. Be sure you understand it for whatever PROM you use. Murphy's Law says you have a 50% chance of programming the PROM with the outputs inverted. I have seen PROMs programmed with the outputs inverted even after checking and double checking spec sheets. If by some fulfillment of Murphy's Law your PROM outputs are inverted, don't fret. You don't have to throw it away. A couple of inverters on the PROM outputs if using 256 x 4's or on the first level mux outputs if using 32 x 8's can correct it. But if you did it wrong the first time and add a second PROM, do it wrong the second time. Otherwise you'll have inverters on the first PROM and not on the second, etc., and it could get to be a confusing mess.

Operation

When the wiring is all completed and double checked, turn on the power. Usually one dot and one dash will be outputted when the keyer is turned on. Capacitors C301, C302, C303 and C304 cause the dot and dash latches to get set when power is turned on. To operate the keyer as a normal IAMBIC keyer, just plug in your squeeze paddle (or regular paddle) and send. Don't become discouraged if you're trying squeeze keying for the first time and find it difficult. I practiced for about three hours before I felt confident enough to put it on the air, but then the results are fantastic. The ease of squeeze keying combined with letter and word spacing will give you a fist to be proud of.

To program the keyer select a starting address and press the PRESET button. The displays will read the address selected. Turn on the PROGRAM switch and send your favorite sequence on the key. When you have completed sending press the STOP STORE button to store away a stop in-



How would you like to see all your trips to Hamfests start paying for themselves?

How would you like to earn enough money to buy that new gear you've had your eye on?

It's really a lot easier than it sounds!

73 Magazine is looking for dependable hams to represent us all across the United States and Canada. Our reps take magazine subscription orders, and sell our books, tapes and QSL cards. And for every subscription you get – for every book or pack of QSL's you sell, you get a WHOPPING big commission for yourself!

You can make over $100 at even a small gathering of hams. And while you're earning that "loot" you'll be doing what you like to do best – Hamming it up! Why not sit down and jot off a note to us right now? You'll have all the facts (and those all important percentages) by return mail. And you'll become a member of our ever growing 73 team. If this sounds like it's for you, Welcome Aboard!

Mail inquiries to: David Behnke
Director of Marketing
73 Magazine
Peterborough, New Hampshire 03458

We're interested in all the following areas.

MIDWEST
- Indiana
- Iowa
- Kansas
- Minnesota
- Missouri
- Nebraska
- North Dakota
- South Dakota
- Texas
- Wisconsin

NORTHEAST
- Connecticut
- Deleware
- Maine
- Maryland
- Massachusetts
- New Jersey
- New York
- Pennsylvania (Eastern)
- Rhode Island
- Vermont

SOUTHERN STATES
- Alabama
- Arkansas
- Georgia
- Louisiana
- Mississippi
- North Carolina
- South Carolina
- Tennessee
- Virginia

PACIFIC STATES
- Alaska
- California
- Hawaii
- Nevada
- Washington

ROCKY MOUNTAIN STATES
- Colorado
- Idaho
- Montana
- Wyoming

ALL CANADIAN PROVINCES

struction. Turn off the PROGRAM switch. Press the PRESET button again to set the memory address counter back to the beginning of the sequence and press the START switch. The keyer will send your sequence and stop at the end of it.

Sequences can be loaded anywhere in memory. Write down the starting location of each so you can keep track of them and select the one you want at the right time. It's better to store them sequentially one after another so you don't accidentally program over something already stored away. Also if a sequence is being programmed near the end of memory and eventually gets to the last location of memory, the address counter will overflow back to location zero and the keyer will continue on. If something was already stored at the beginning of memory it will be written over and lost.

To use the repeat feature first decide what you want to send and which part you want to repeat. For example, to have the keyer send CQ DE W1GCA CQ DE W1GCA K (stop) program it as follows: Select a starting location, say 1000. Press the PRESET switch and turn on the PROGRAM switch. Send CQ DE W1GCA. (Display reads 1046, right?) Press the REPEAT STORE switch and then send the letter K. Press the STOP STORE switch, and turn off the PROGRAM switch. (Display reads 1054). Press the PRESET switch to set the memory address counter back to location 1000. The address switches must be left at 1000 when sending the sequence for it to come out properly. Press the START switch and the keyer will send CQ DE W1GCA CQ DE W1GCA K (stop).

One other feature the keyer has, although I haven't found a very practical use for it yet, is to cascade two sequences. You can have the keyer send a message and by use of the repeat instruction have the keyer jump to another message. Start at location 0000 and program HI. The display reads 10. Press the repeat store switch. Now select another address, for example, 50. Press the preset button and program in GANG. The display reads 66. Press the stop store switch and take the keyer out of programming mode. Select 0000 on the address switches and press the preset button. Now select 50 on the address switcher but do not press the preset button. Press the start switch and the keyer sends HI. Then it comes to the repeat instruction and presets the counter to the address selected by the switches, which normally should be the starting location for the message being sent, but in this case it isn't. Instead of repeating HI, the keyer goes to memory location 50 and continues on to send GANG, and then stops. You can only do it once though, because the REPEAT FF gets set and any further repeat instructions are ignored.

Signal number	Signal name	Used on figure number				
		3	5	8	13	14
1	CLOCK	x	x			
2	CLOCK2 BAR	x	x			
3	EOI•CLOCK2	x		x		
4	EOI•CLOCK BAR	x		x	x	
5	KEY DASH IN PROGRESS	x			x	
6	KEY DOT IN PROGRESS	x			x	
7	KEY DOT + KEY DASH IN PROGRESS BAR	x		x		
8	MEMORY WS NEXT OP CODE	x		x	x	
9	MEMORY LS NEXT	x	x	x		
10	MEMORY DASH NEXT	x		x		
11	KEY WS NEXT BAR	x		x		
12	MEMORY WS NEXT NEXT BAR	x		x		
13	RUN	x	x		x	
14	KEY NEXT	x		x		
15	WSFF + LSFF	x		x		
16	EOI DELAYED BAR	x		x		
17	OUTPUT	x				x
18	OUTPUT BAR	x				x
19	WSFF	x	x		x	
20	KEYMODE FF	x		x		
21	CLOCK2		x	x		
22	CLOCK BAR		x		x	
23	STOP NEXT BAR		x	x		
24	STOP + REPEAT STORE BAR			x	x	
25	REPEAT SKIP BAR			x	x	
26	RAM A INPUT			x	x	
27	RAM B INPUT			x	x	
28	PRESET			x	x	

Fig.19. Final assembly figure interconnection check list.

Conclusion

The keyer has added a new dimension to CW operation and using it on the air has certainly been a pleasure. I find myself programming little short phrases into it to have at instant recall whenever I want to send them. All comments received on the air have been favorable as to the keyer's timing of characters and spacing of characters. I think it competes with W1AW's code practice machine! . . . W3HPX

Robert Suding W0LMD
370 South Queen Street
Lakewood CO 80226

August 73 Scan Converter Update

The following changes are to be made in the camera scan converter article which appeared in August, 1974 issue of 73 Magazine.

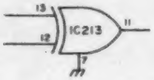
Significant Text Errors:

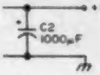
Page 77 Right column Line 8: ≈MHz should be ≈5MHz Page 80 Line 29: TP14 should be TP13.

Parts List:

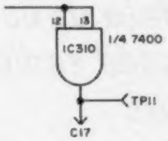
C105, C301* should be .001 Silver Mica
C107 should include 4.7mfd, 10v tantalum
C109* should be .0033 Mylar (.003 ok, though.)
C210, C202, C203 should read C201, C202, C203
C204, C205 should be 560 pf silver mica
C206*, C207* should be 47 pf silver mica
C209* should be a 800 pf silver mica
C302 is a .1 mfd Mylar
R1 is 200K
R2, R4 are 100K chassis mounted pots
R3 is 470K
R101 is 1.5K
R111▲, R113, R126 should be R111▲, R113, R306
R302, R306 should be only R302
Add: R308. . .390Ω

In addition:


13
12
IC213
11
7



Move TP11 from the present location to:


12
13
IC310
1/4 7400
TP11
C17

Scope Patterns:

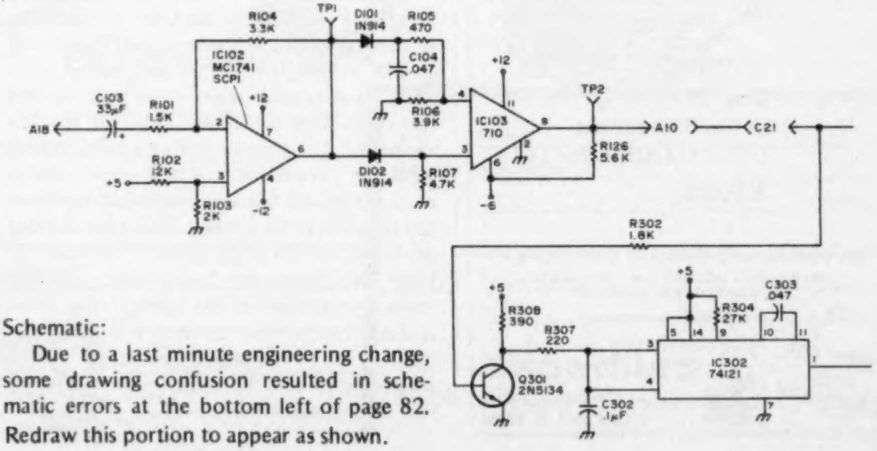
The first dual trace pattern on page 78, showing TP21 and TP22 should read " - trigger".

Misc.

In the "volts" box of the bypass table on page 83, insert " -6" in the blank box between +12 and -12.

The following list of IC functions was edited out of the schematic. This list may be of use to your understanding of component functions.

IC101 – White and Black Compression
IC102, IC103 – Sync stripper
IC104 – D/A Converter
IC105 – LPAF and D/A Amplifier
IC106 – VCO


R104
3.3K
TP1
D101
IN914
R105
470
IC102
MC1741
SCP1
C104
.047
+12
C103
33μF
R101
1.5K
A18
R106
3.9K
IC103
710
TP2
A10
C21
R102
12K
+5
R103
2K
-12
D102
IN914
R107
4.7K
R126
5.6K
-6
R302
1.8K
+5
R308
390
R307
220
R304
27K
C303
.047
IC302
74121
Q301
2N5134
C302
.1μF

Schematic:

Due to a last minute engineering change, some drawing confusion resulted in schematic errors at the bottom left of page 82. Redraw this portion to appear as shown.

IC202 to IC209 – A/D Converter
IC212 – Memory
IC213 – Gray to Binary Converter
IC214 – Reverser
IC215 – Video/Gray Scale Multiplexer
IC216 – 2 Phase Clock Driver
IC301, IC302 – Sync Separator
IC304 to IC306 – Vertical Counter
IC307, IC308 – Line Sample Selector
IC309 – 8-8.5 Seconds Gate
IC311 – Horz Sync Singleshot
IC312 – Vert Sync Singleshot

Several foreign hams have noted a picture foldover problem when operating from 50Hz lines. A "fix" is being investigated and will be reported later.

Jacking the Galaxy Transceivers

The earlier Galaxy III and V transceivers have no provision for using a pair of high-impedance headphones. These transceivers just happen to have a hole in the back panel for use with a remote vfo – you are supposed to run a length of coax through this hole to the phono jack that is mounted on the side of the vfo enclosure. Not many hams use a remote vfo with their transceiver, but more would like to use a set of high-impedance headphones instead of the speaker.

It just happens that a standard phone jack receptacle will fit into this hole very handily. A plate-to-voice coil audio output transformer will fit into the case of the Galaxy quite easily. I mounted mine under one of the screws holding down the cover of the vfo enclosure. The transformer's high impedance leads are connected to the newly-added phone jack and the low impedance leads are connected to the speaker jack that Galaxy provided on the back pane'. You can use your high impedance headphones with the transceiver instead of the speaker, and when trading time comes, the jack and the transformer can be removed with no marks remaining to tell the dealer you had modified the transceiver.

. . .WB6PKA

CALL BOOK 74

When you want an authoritative, up to date directory of licensed radio amateurs
It's the
CALLBOOK

Over 210,000 QTH's in the DX edition
DX CALLBOOK for 1974
$8.95

callbook
callbook

Over 285,000 QTH's in the U.S. edition
U.S. CALLBOOK for 1974
$9.95

See your favorite dealer or Send today to
(Mail orders add 50¢ per CALLBOOK for postage and handling)

WRITE FOR FREE BROCHURE

RADIO AMATEUR callbook INC.
Dept. B 925 Sherwood Drive
Lake Bluff, Ill. 60044

HOLIDAY *Gift* SUBSCRIPTIONS

Want to give a gift that . . .

Informs?
Stimulates?
Fascinates?
Entertains?
Permits "easy chair" shopping? *GIVE 73 MAGAZINE!*

We want to help you CUT THOSE HOLIDAY GIFT COSTS. The first subscription to 73 is just $6.00. That's a 50% savings over the newsstand price, and $2.00 off our new subscription price of $8.00 per year (effective January 1, 1975). Each additional subscription will cost the unbelievably low price of ONLY $5.00. And that's a savings of 58%. Take advantage of this fantastic year end savings from 73 Magazine. SEND US NO MONEY WITH THIS ORDER. We know how expensive this time of year is for you and we don't want to add to the burden. So, don't worry about it now. We'll bill you later after the first of the year.

Gift from

NAME
ADDRESS

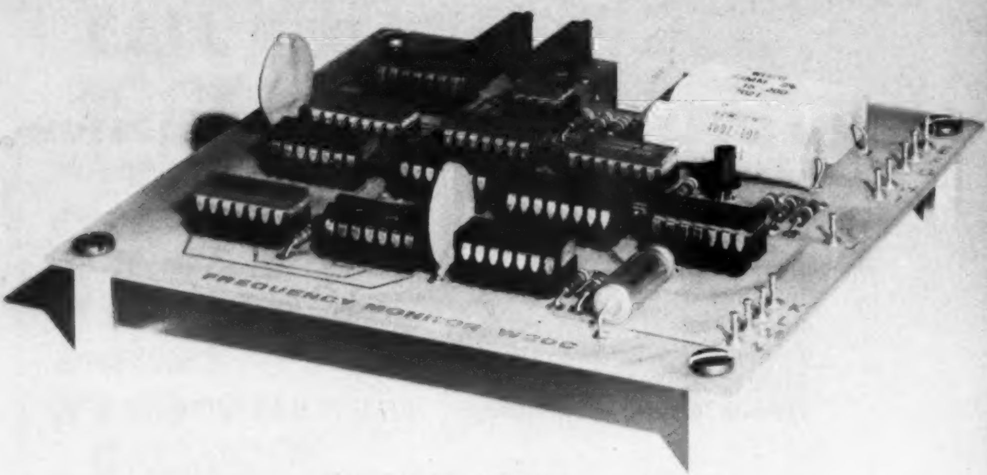
CITY
STATE

ZIP
BILL ME LATER
CALL

# 1
$6.00
NAME
ADDRESS
CITY STATE ZIP

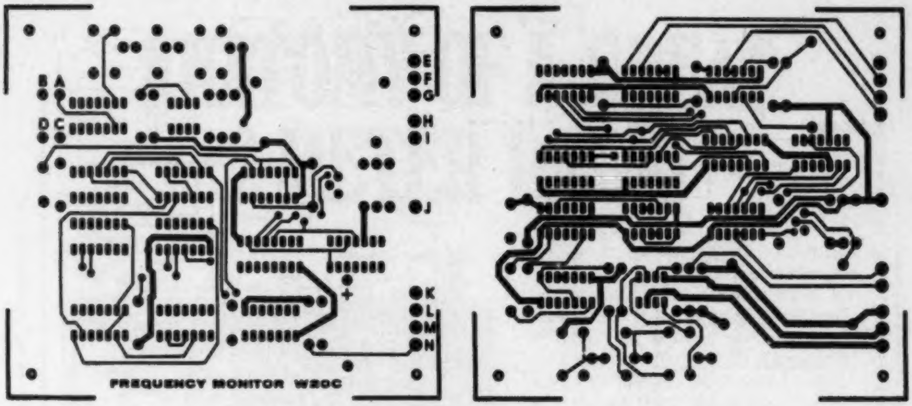
# 2
$5.00
NAME
ADDRESS
CITY STATE ZIP

# 3
$5.00
NAME
ADDRESS
CITY STATE ZIP


FREQUENCY MONITOR W2OC

Beep-Beep-Beep-Beep, You're High

Digital unit to automatically tell repeater users whether they are high or low in frequency. What self-respecting repeater group can pass up this bit of frosting?



Front and back layout of the board – one half size here.

Bill Fisher W2OC
2 Barnard Road
Armonk NY 10504

One of the most common adjustments that operators on FM repeaters find necessary to make, at one time or another, is the crystal trimming adjustment required to set their transmitters "on frequency." Most hams prefer to use a frequency counter to accomplish this, but although these instruments are increasing in number in ham shacks every day, they are still not readily available to the majority of operators. The alternative method of frequency adjustment usually employed is to be "talked on" frequency by someone at the receiver site watching a discriminator meter. This assistance, unfortunately, is not necessarily available very often or at a convenient time. The frequency monitor to be described here was designed to enable an operator to set his transmitter on frequency without the need for either a frequency counter or outside assistance. Furthermore, once this adjustment is made, the frequency monitor will continue to provide a constant check on it and automatically indicate if, and when, further adjustment is required.

The frequency monitor is installed at the repeater, connected to the input frequency receiver, where it continuously monitors the output of the discriminator. When it detects a received carrier which is removed from the center frequency by a given amount, it signals this to the digital circuitry and also indicates whether the carrier is above or below the center frequency. This information is *temporarily stored* by the monitor *until* the carrier is removed from the receiver input. At that time the information is then transmitted by the repeater input. At that time the information is then transmitted by

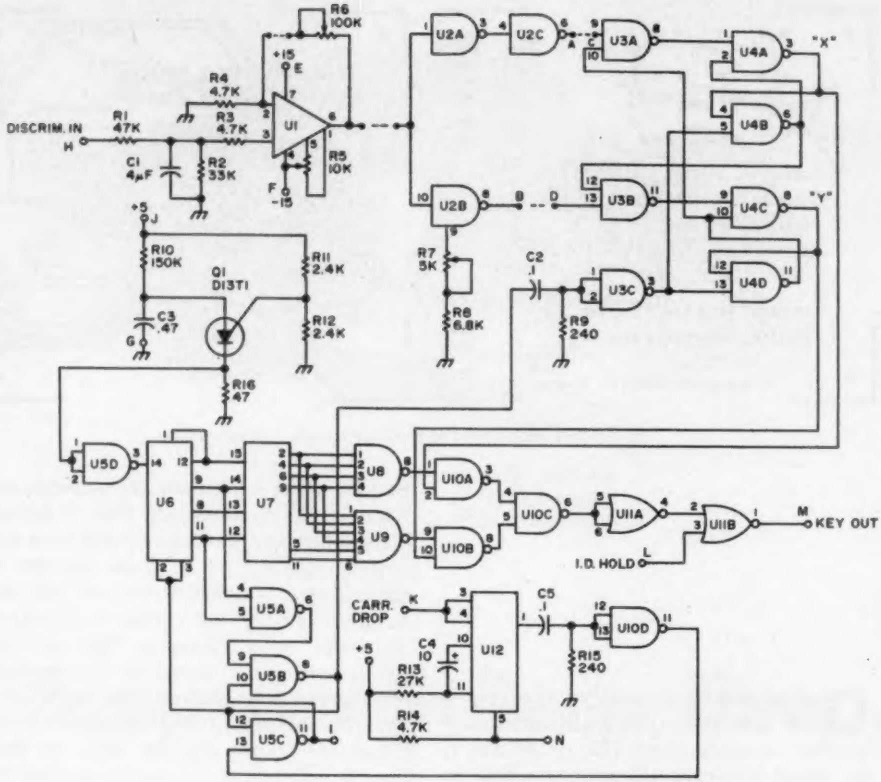
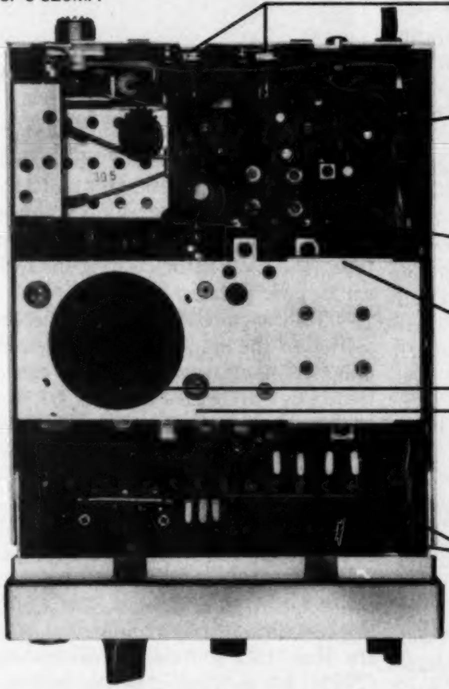

R6
100K
+15
E
R4
4.7K
R1
47K
R3
4.7K
DISCRIM. IN
H
C1
4μF
R2
33K
U1
R5
10K
F
-15
+5
J
R10
150K
Q1
D13T1
R11
2.4K
C3
.47
G
R12
2.4K
R16
47
U2A
U2C
A
C
U3A
U4A
"X"
U4B
U2B
B
D
U3B
U4C
"Y"
R7
5K
R8
6.8K
C2
.1
R9
240
U3C
U4D
U5D
U6
U7
U8
U9
U10A
U10B
U10C
U11A
U11B
M
KEY OUT
L
I.D. HOLD
U5A
U5B
U5C
I
CARR. DROP
K
+5
C4
10
R13
27K
R14
4.7K
U12
C5
.1
R15
240
U10D
N

Fig. 1. Schematic of the high-low frequency monitor.

the repeater in Morse code in the form of a letter "H" or a letter "L" if the signal was high or low with reference to the center frequency. If, however, the received carrier at the repeater is within a frequency "window" (± 750 Hz from center), no Morse letter will be sent. The operator, therefore, merely has to adjust the crystal trimmer until he no longer hears an "H" or an "L" when he releases his push-to-talk button, indicating that he is within the "window." This frequency window is adjustable to whatever limits are desired, but the ± 750 Hz spread used at WR2ACI, White Plains, N.Y., has been found to be a practical figure.

The frequency monitor is designed to have its output key the same audio oscillator used for the repeater I.D. It also requires two logic signals normally present in I.D./control circuitry. They are: (1) a so-called "carrier drop" signal which falls from a high (>2.4 v.) to a low (<0.8 v.) whenever a carrier *is removed* from the receiver input, and (2) a so-called "I.D. hold" signal which remains high *during* the I.D. Referring to Fig. 1, operation of the circuit is as follows: The output of the receiver discriminator is connected through R1 and R3 to the noninverting input of U1, a 5556 op amp. (Note: The point of connection at the receiver is the same one ordinarily used for a zero-center microammeter.) The discriminator output is amplified by U1 and appears at pin 6. This bi-polar (i.e. positive and negative) signal at pin 6 is then presented to U2, pins 1 and 10. U2 is a 1489 which has four identical sections and is specifically designed to accept bi-polar signals and convert them to zero and +5 volt logic levels. Each section can be individually adjusted to

ANATOMY OF A GREAT 2-METER RADIO



sr-c 826MA

Rear panel test jacks for complete Tx and Rx metering and discriminator output for crystal netting; Input for external tone burst and Touchtone®; Provision for external speaker.

Conservative 10 Watt transmitter with an effective IDC circuit to maintain narrow band deviation (±5KHz) for today's repeaters; Automatic current Control and final protection against high VSWR.

Provision for front panel selectable "Private Channel" tone coded squelch (CTCSS) on both receive and transmit.

Triple tuned receiver "Helical Resonators" for maximum intermodulation interference rejection.

Built-in speaker.

The heart of a quality radio—a commercial grade receiver featuring Front-end MOS-FETS and a highly selective 9 section ceramic I.F. filter—necessary for today's active 2 Meter band; Reserve audio for noisy environments.

Individual "Netting" capacitors on both Tx and Rx crystals; 12 channel provision with popular channels 94/94, 34/94, 16/76 and 52/52 included; Easy access to crystal deck through "snap-open" trap door.

Touchtone®—trademark of A.T.&T. Co.

ASTROPOINT = TOTAL PERFORMANCE

STANDARD's "ASTROPOINT" system gives the no compromise performance for the active amateur, unlike the claims made by the "cheapies." Don't be misled by gimmicks or gadgets—it's what's inside that counts. Reliable, solid state circuitry and Glass-Epoxy PC boards used throughout, backed by our 6 month warranty. INSIST ON TOTAL PERFORMANCE—INSIST ON STANDARD.

The 826MA comes complete with microphone, mounting brackets, 4 channels and line filter.

For detailed information on the 826MA, the complete Standard line and the name of your nearest dealer write:

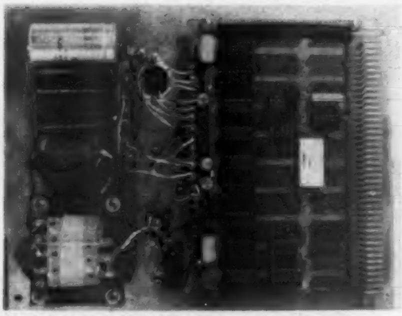
Standard
Communications

213/835-3134 • 639 North Marine Avenue, Wilmington, California 90744 a specific positive or negative threshold level and in this case one section (U2A) is set for a positive threshold of approximately 1.2V and another section (U2B) is adjusted for a negative threshold of equal value. A third section (U2C) is merely used as an inverter. (The fourth section is not used). Let's assume that a carrier is received which is just outside the high frequency limit of the window (i.e. 750 Hz high) and that this produces a positive voltage swing. The gain of U1 would then be adjusted (by means of R6) so that, under these conditions, pin 6 would just reach the threshold level of U2A (approximately +1.2 volts). When U2A sees this level, its output (pin 3) drops abruptly from a high (approximately +4V) to a low (approximately zero V). This low is then inverted by U2C and again by U3A causing RS flip flop U4A/U4B to "set" pin 3 (point X) high. Similarly, if a carrier is received which is just outside the low frequency limit of the window (750 Hz low), pin 6 of U1 would just reach the threshold of U2B (approximately -1.2 volts) and pin 8 of U2B would rise abruptly from a low to a high. This high would then be inverted by U3B and cause RS flip flop U4C/U4D to "set" pin 8 (point Y) high. In summary, therefore, point X will go high if a signal on the high side of the frequency window is received and point Y will go high if a signal on the low frequency side of the window is received. As soon as one of these points goes high, it will remain high (until cleared) and simultaneously the other point is inhibited from going high by means of the transposed connections to pins 10 and 12 of U3A and U3B, respectively. This inhibit action insures that only one indication is processed at a time. The method of clearing the flip flops will be covered later.

IC #	IC Type	+5V PIN	GAD PIN
U1	5556	#	#
U2	1489	14	7
U3	7400	14	7
U4	7400	14	7
U5	7400	14	7
U6	7493	5	10
U7	7442	16	8
U8	7430	14	7
U9	7430	14	7
U10	7400	14	7
U11	7402	14	7
U12	74121	14	7

* PIN 7 = +15V
PIN 4 = -15V

Table 1.



Prototype monitor and power supply.

U5 through U12 comprise the readout section of the monitor. Q1, a programmable unijunction, provides the clock signal. The frequency of oscillation of Q1 can be adjusted by selecting the value of R10. The 150K, shown for R10 in Fig. 1, corresponds to a code speed of approximately 20 wpm. Incidentally, if it is convenient to use a freerunning clock signal from existing I.D. circuitry, Q1 and its associated components may be omitted and the external clock signal connected to pins 1 and 2 of U5D. Assuming, for the moment, that pins 2 and 3 of U6 are low, U6, a four bit binary counter (7493), will be clocked by the oscillator (via U5D) and U6's binary output (pins 12, 9, 8 and 11) will address the inputs of U7, a one of ten decoder (7442). The outputs of U7 are connected to U8 and U9 in such a manner as to program (in Morse code) an H from U8 and an L from U9. The two outputs of U8 and U9 are gated through U10A and U10B, respectively. Point X, as previously discussed, when high, indicates a signal on the high side of the window. Point X connected to pin 2 of U10A, therefore, will permit the H to pass when it is high and Point Y, connected to pin 10 of U10B, will permit the L to pass when it is high. Whichever signal is permitted to pass is then routed through U10C, U11A and U11B. The purpose of U11B is to permit inhibiting any

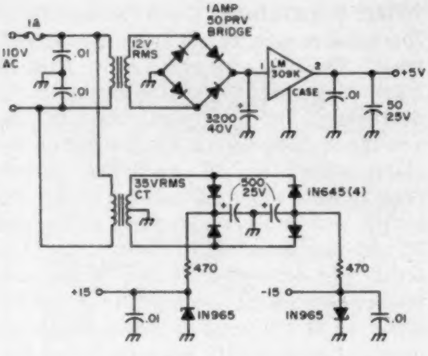


Fig. 2. Power supply, if needed.

Morse code output from the monitor while the repeater I.D. is being sent. To implement this inhibit action it is necessary to apply the "I.D. hold" signal (from existing I.D. circuitry) to pin 3 of U11B.

In the resting, or idle, state of the monitor, pins 2 and 3 of U6 are high and thus inhibit U6 from being clocked. Whenever a carrier is removed from the receiver input, however, the "carrier drop" signal causes pins 3 and 4 of U12 to go from a high to a low. This, in turn, causes U12, a one-shot multivibrator (74121), to produce a *negative-going* pulse at pin 1. The duration of this pulse is determined by R13 and C4, and for the values shown, is approximately 200 ms. Thus, 200 ms after the carrier drops, pin 1 of U12 *returns* to its high state and momentarily causes pins 12 and 13 of U10D to go high (via C5). Pin 11 of U10D, therefore, momentarily drops to a low causing RS flip flop U5B/U5C to set pin 11 of U5C (point I) high and pin 8 of U5B low. This results in pins 2 and 3 of U6 going low, allowing U6 to be clocked and thus initiates transmission of a frequency indication. Note that U6 will be so clocked each and every time a carrier is removed from the receiver input but a letter will be transmitted only if point X or point Y has been set high due to the carrier having been outside the frequency window. If neither X or Y is high, even though U6 goes through its counting sequence, the lows appearing at pins 2 and 10 of U10A and U10B will prevent any output from them. Similarly, when a carrier drop initiates an I.D., U6 will also be clocked, but even if X or Y is high at that time, pin 3 of U11B will be held high during the I.D. sequence and so inhibit any output from the monitor. Once clocking of U6 is initiated, it will continue counting until the count of 10 when pins 9 and 11 are both high. When this occurs, pins 4 and 5 of U5A also go high causing pin 6 of U5A to go low, resetting RS flip flop U5B/U5C. This resetting once again places a high on pins 2 and 3 of U6 resetting it and also inhibiting further clocking. U6 remains in this state until the next carrier drop which starts the whole sequence over again. The reason for the one-shot multivibrator is merely to provide a suitable time interval between the dropping of the carrier and the transmission of the frequency indicating letter.

Simultaneously with pins 2 and 3 of U6 going high at the end of the counting sequence, pins 1 and 2 of U3C momentarily go high (via C2). This causes pin 3 of U3C to momentarily go low and thus reset both RS flip flops U4A/B and U4C/D. This resetting ensures that both points X and Y are reset to low to prepare them for the next frequency indication.

Point I in Fig. 1 is provided for those repeaters which do not employ any transmitter drop-out delay and can be used with existing control circuitry to ensure that the transmitter is held on for the duration of the readout sequence (approximately 1 second).

The prototype unit was constructed on an experimental type PC board which accepts the mounting of a multitude of ICs, all of which must be interconnected by hand-wiring. The board and its power supply was then mounted on a 7 x 10 panel and this panel then mounted in a 7 x 10 chassis so as to completely enclose the unit and provide effective shielding. With the PC board now available, a smaller enclosure may be used but shielding should still be provided for the monitor, as it should be for any solid state unit to be operated in the vicinity of a vhf transmitter. A 9 pin socket was used for the interconnecting (shielded) cable used to interface the monitor with the I.D./control circuitry. The lead from the receiver discriminator was brought in separately via an ordinary RCA type phono plug. This lead was also shielded and because of the location of the receiver at the WR2ACI repeater site, was about 25 feet long.

Initial adjustment of the frequency monitor should begin by setting the threshold levels of U2A and U2B. Temporarily remove the jumper connecting pin 6 of U1 to pins 1 and 10 of U2. Next, apply a variable voltage source of approximately 0 to 2V dc to pins 1 and 10 of U2. (Any handy potentiometer connected across a flashlight battery will suffice to provide this variable voltage.) With just the 5 V supply connected to the frequency monitor, slowly vary the voltage to pins 1 and 10 of U2 while monitoring pin 3. As you bring the voltage up from zero, pin 3 will abruptly drop to zero from about 4V when the voltage on pin 1 reaches approximately +1.2V. Make note of the exact voltage on *pin 1* when this drop at pin 3 occurs. We will call this the positive threshold of U2A. Reverse the voltage (battery) polarity on pin 1 and 10 of U2 and monitor pin 8 of U2B. As you increase the voltage on pins 1 and 10 of U2 (in a negative direction), the voltage on pin 8 will abruptly rise from zero to about 4 volts. The threshold adjustment for U2B consists of setting R7 so that this abrupt change from low to high occurs at the same voltage on pin 10 (but negative in polarity) as previously noted for the positive threshold of U2A. Once set, this adjustment need not be touched again.

Disconnect the variable voltage source from pins 1 and 10 of U2 and reconnect the jumper between pin 6 of U1sand pins 1 and 10 of U2. Set R6 to about mid-range and verify that there is a jumper between pin 2 of U1 and the end of R6 as shown in Fig. 1. Connect the ±15V supply to the frequency monitor, ground point H and monitor pin 6 of U1 with a voltmeter. Adjust R5 for zero (off-set) voltage indication of the voltmeter. This adjustment, like the previous one, is made once and then left alone. Remove the ground from point H, connect the 5V and the ±15V supplies to the monitor and attach the variable voltage source to point H. For this step the voltage applied to point H should be variable in the range of 0 to ±0.2V. While varying the voltage to point H, monitor the voltage at pin 6 of U1. Pin 6 should follow the polarity of the input voltage as you change it and also indicate an approximate gain of 10 (with R6 at mid-range). The final adjustment of R6 must be made with the monitor connected to the discriminator of the repeater receiver. The amount of gain required will depend on the characteristics of the particular receiver being used. If additional gain is required, the jumper provided between pin 2 of U1 and R6 can be replaced with a 100k resistor. The actual gain setting of R6 will be the one which produces the ± voltages at pin 6 of U1 which are exactly equal to the previously set threshold levels of U2 *when* calibrated frequency signals, set to the desired high and low frequency limits, are fed, in turn, to the receiver input.

The connections between U2 and U3 shown in Fig. 1 (i.e. A to C and B to D) are to be used if a positive output from the receiver discriminator indicates a signal on the high frequency side of center frequency. If, however, the discriminator produces a negative output for a high frequency signal, these connections will have to be transposed so that A connects to D and B connects to C. (The PC board available provides convenient pads to facilitate these changes).

The time constant formed by R1, C1 at the input to the op amp is employed to allow time for transmitter oscillators (particularly frequency synthesizers) to "settle" before being processed by the monitor. Note: C1 must be a paper capacitor (not electrolytic).

Fig. 2 shows a suitable power supply for the monitor. If convenient, the unit may be powered from an existing power supply at the repeater. The monitor requires approximately 150 mils for the 5 volt digital circuits and 2 to 3 mils for the ±15V supplied to the op amp.

Point N is provided to permit inhibiting operation of the frequency monitor, when desired, by remote control via control circuitry. To inhibit the monitor, Point N should be grounded.

This frequency monitor has been in continuous service at WR2ACI since January, 1974 and I am sure that other repeaters will find it to be, as we have, a useful addition to their system.

. . .W2OC

73
ANNUAL
NOVEMBER
73

SPECIAL BACK ISSUE OFFERINGS 2

Now you can build up your ham library for next to nothing!

PACKAGE A — *25 different issues (of our choice) for ONLY $5.00. That's just 20¢ an issue – it costs us more than that to print them! Choose from three different categories:*

Vintage: 1962-1965
Recent: 1966-1969
Very Recent: 1970-1973

PACKAGE B — *A complete set of 12 issues for a particular year for only $3.95. At only 33¢ an issue, you're still saving a bundle. Choose any year(s) from 1963-1973. Should we run out of a particular issue, you will receive a 50¢ credit.*

Great Gift Idea! — *Why not send the hams on your list a complete year of 73s in one of our handsome red binders with gold and black lettering. Special holiday price, $7.75. (The regular price of the binder alone is $5.00!) Come to think of it, why not give one to yourself?!*

BACK ISSUE OFFERS

PACKAGE A ($5.00 EACH)
☐ Vintage: 1962 – 1965
☐ Recent: 1966 – 1969
☐ Very Recent 1970 – 1973

PACKAGE B ($3.75/year)
☐ year(s) ________
☐ with binders ($7.75 each) ____
Total Enclosed $ ________

HURRY WHILE OUR SUPPLY LASTS. ALL ORDERS ON A FIRST COME, FIRST SERVED BASIS.

— — — — — — — — — — — — — — — —

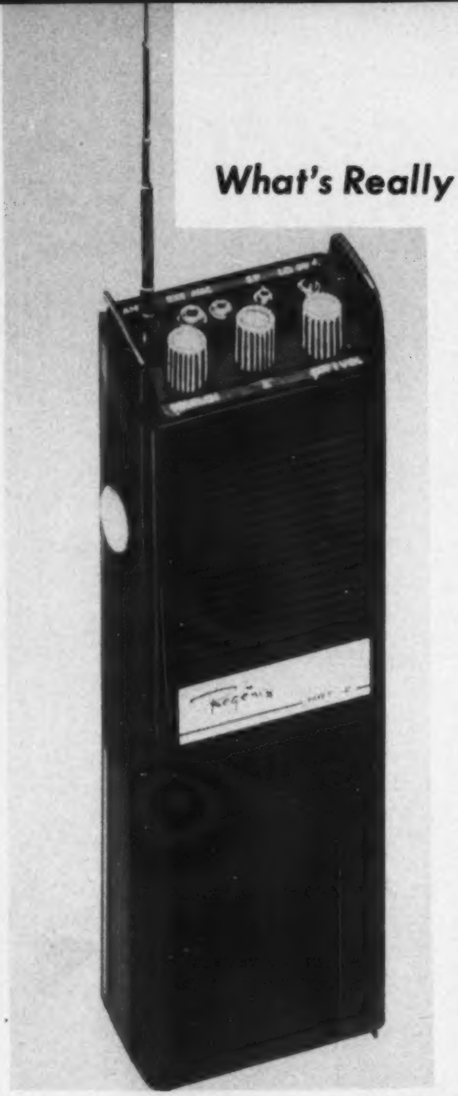
Name ______________________ Call __________

Address ______________________________

City ______________ State ______ Zip __________

Kent A. Mitchell W3WTO
1004 Mulberry Avenue
Hagerstown MD 21740

What's Really Inside The Regency HT?



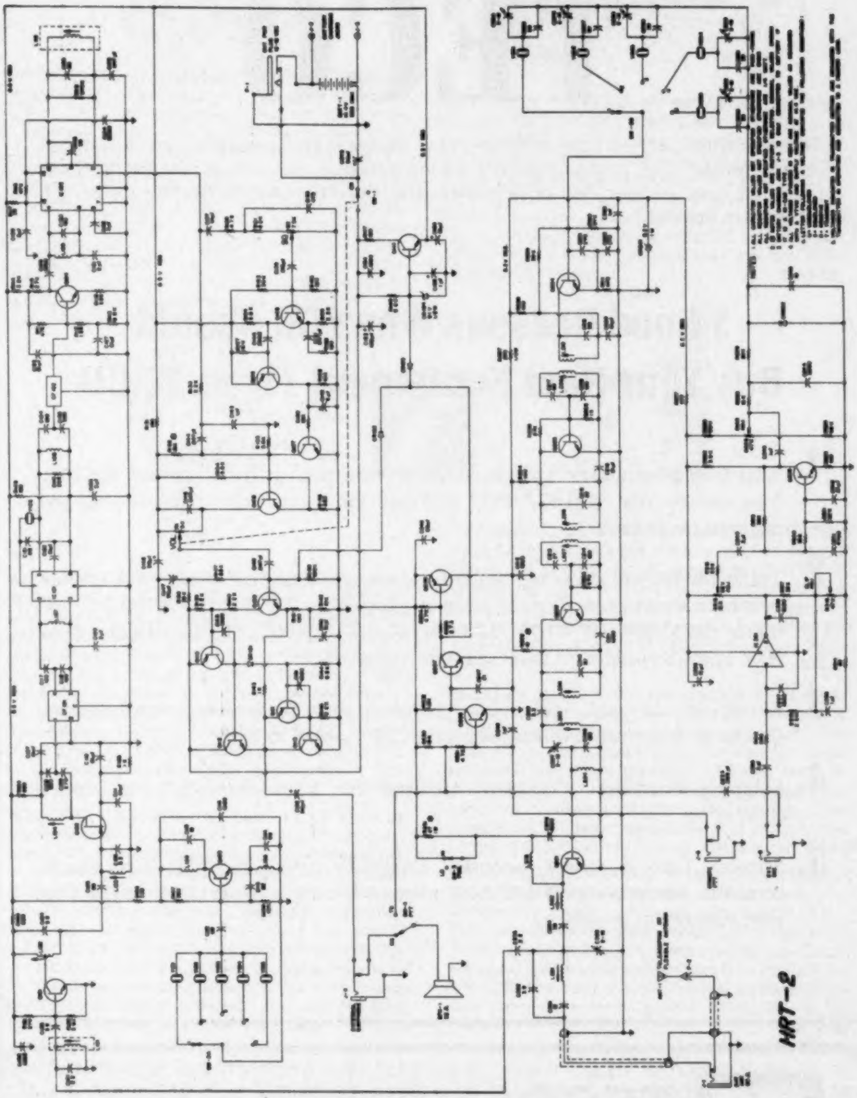
If you have been in the market for a hand-held transceiver for the 2-meter FM frequencies, you are by now aware that there are several such units on the market and that there is much diversity in both features and price. One unit, which is at the lower end of the price scale while still retaining a respectable position on the features chart, is the Regency Model HRT-2.

This transceiver is a five channel, all solid-state (3 IC's, 22 transistors, 6 diodes), compact package featuring a Hi-Low rf output of 1W/2.2W and a receiver sensitivity of 0.7 uV for 20dB quieting. Individual netting capacitors are provided for each of the 5 transmitting and 5 receiving crystals. All crystals are the plug-in type. Frequency modulation is generated via the standard biased varactor diode arrangement. An internal pot permits deviation adjustment from 0 to 7 kHz and is factory set at approximately 5 kHz. The receiver section is a double-conversion, super-hetrodyne design and uses two ceramic filters to assist in cross-channel interference rejection. Both transmitter and receiver are designed to operate uniformly across the entire 144-148 MHz band. Plug jacks are provided for using an external microphone with a remote PTT switch. (This is required when the rig is worn with a belt clip – a convenient mode of operation.) An external earphone jack is likewise provided.

The HRT 2 does not come battery equipped from the factory, leaving the operator with the choice of purchasing either the mercury type or the more expensive, rechargable, nickel-cadmium battery pack. The ni-cad need not be removed from the transceiver for recharging, as there are two recessed contacts located on the bottom of the unit for this purpose. NOTE: these contacts are automatically *not* connected when a mercury battery is installed. . .they tend to make loud noises when an attempt is made at recharging. The battery charger, a rubber duckey antenna, external microphone, earphone, etc., are available from Regency.

One other feature of the handie-talkie, not yet mentioned, is that its case is made of Acrylonitrile-Butadiene-Styrene. Say that three times real fast! In other words, high impact plastic, for when the time comes that you will drop the unit from your beer can type grip.

Priced at $179.00, Regency should sell a lot of these radios. . . .W3WTO



Behold, the complete schematic.

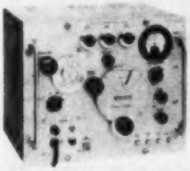
TECO

Teco is a subsidiary of Tucker Electronics. Tucker is the world's largest supplier of reconditioned test equipment, the original tested instrument DISTRIBUTOR (with 18 lines of new test equipment), and the Southwest's leading repair and calibration facility.

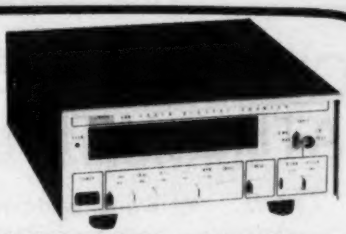
5 Good Reasons Why YOU Should Buy Your Ham Equipment From TECO

1. Wats Communication: You can shop by either mail or by telephone, toll free. You merely dial 800-527-4642 and ask for Teco. Your questions will be promptly answered.
2. Trade-ins: We will allow top dollar for your excess test equipment in trade for new ham equipment. Typical trade-in allowances: HP 200 CD ($100.00), HP 608D ($600.00), HP 410B ($90.00), Bird 611 ($100.00). We will also take Ham and CB equipment and calculator trade-ins.
3. Financing: You can finance your purchase through BankAmericard, Master Charge or American Express, with up to 24 months to pay.
4. Shipping Facilities: Complete facilities for both domestic and export shipments.
5. Service: Teco is service oriented. Complete service facilities in-house. A complete comprehensive technical manual library is available to assist you with equipment problems.

TECO a subsidiary of Tucker Electronics Co.
SURPLUS TEST EQUIPMENT FOR BARGAIN HUNTERS
P.O. BOX 1050-A 322 KIRBY ST. GARLAND, TX. 75040
214-348-8800



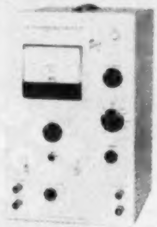
HP 616A SIGNAL GENERATOR: Direct reading and direct control from 1.8 to 4.2 GHz. The HP 616A fea5ures ±1.5dB calibrated output accuracy from −7dBm to −12dBm. The output is directly calibrated in microvolts and dBm with continuous monitoring. Simple operation, frequency dial accuracy is ±1% and stability exceeds 0.005%/°C change in ambient temperature. Calibrated attenuator is within ±1.5dB over entire output band. 50 ohm impedance unit has internal pulse modulation with rep rate variable from 40 Hz to 4 KHz, variable pulsewidth (1 to 10μsec) and variable pulse delay (3 to 300μsec). External modulating inputs increase versatility. New price exceeds $2000.00.
TECO PRICE **$495.00**



NEW FLUKE COUNTER AT BIG CLOSEOUT DISCOUNT SALE-WHILE THEY LAST $249.95: The Fluke 1941A 5 Hz to 40 MHz range with frequency, totalize and RPM functions. Big 6-digit gas-discharge display and five standard gate times. The input sensitivity is 40 mVrms with push-button attenuator, all push-button range selection, switchable low pass filter. Don't miss this fantastic never-to-be-repeated, nationally advertised offer. One year full warrentee - you can't lose.
Fluke 1941A Counter **$249.95**

BALLANTINE 300H VTVM: The 300H is a compact, conservatively designed instrument for applications where high accuracy, low maintenance cost, long life, freedom from power line disturbances and simplicity of operation are of prime importance. Its basic accuracy of 2% of reading combined with calibration stability of 5000 hours and high sensitivity of 30μV in the null detector mode makes the 300H a versatile laboratory tool. It is also usable as a 40dB gain wide band amplifier. Voltage range is 300μV to 300V with frequency range from 10 Hz to 1 MHz, input impedance of 2MΩ shunted by 15 or 25pF and −10 to +10 linear dB scale **$130.00**

MILITARY AN/UPM-15 200 VOLT PULSE GENERATOR: A portable, general purpose pulse generator set used for testing pulse amplifiers and networks, and for modulating oscillators in field and depot maintenance. It generates single or double pulses of variable repetition rate, width, amplitude, separation, delay and rise decay time. The pulses may also be synchronized with oscillators or other instruments. Output rep rate is externally or internally variable from 50 Hz to 10 KHz, pulsewidth variable from 0.5 to 100μ seconds, amplitude 0.002 to 200 volts and calibrated delay from 2 to 225μsec. An extraordinary value ...**$75.00**



TEXTRONIX 105 SQUARE-WAVE GENERATOR: From 25 Hz to 1 MHz and with a risetime of less than 20nsec into a terminated 93 ohm cable - the 105 will generate up to 15V and more than 15mA peak-to-peak. Precision square waves over the complete range make the 105 a perfect instrument for testing amplifiers and other test instruments. The TECO price makes it even better **$75.00**

MILITARY UPM-4A TRANSPONDER TEST SET: Three piece unit in single cabinet includes power supply, simulator unit and oscilloscope display unit. The UPM-4A performs many measurements on radar equipment operating in the 925 to 1225MHz range including checks on decoding, receiver bandwidth and frequency, receiver sensitivity, pulse counting, pulse analysis and IFF target generators. This unit sold new for nearly $5000 but at TECO its cost is a low..**$250.00**

MEASUREMENTS MODEL 95 (MILITARY VERSION SG-3) STANDARD FM SIGNAL GENERATOR: A super buy. Perfect for the Ham using the 220 MHz, 2 or 6 meter bands. Frequency range is 50 to 400 MHz in three bands and a ±0.5% direct reading dial. Output voltage is continuously variable from 0.1 to 100,000μV into 50Ω. The many features in these excellent condition instruments make this the TECO buy of the quarter **$475.00**

CAUTION: THESE INSTRUMENTS ARE SOLD AS-IS. WHILE EVERY ATTEMPT IS MADE TO ASSURE COMPLETENESS AND TO DELIVER AN OPERATIONAL INSTRUMENT, THERE IS NO WARRANTY IMPLIED OR STATED EXCEPT: "YOU MAY EXAMINE THE UNIT FOR TEN DAYS AND, IF YOU ARE NOT SATISFIED, YOU MAY RETURN FOR FULL CREDIT PAYING ONLY THE FREIGHT CHARGES". EVERY TECO INSTRUMENT IS CONSIDERED TO BE A GENUINE BARGAIN, BUT THE BUYER SHOULD HAVE ACCESS TO COMPETENT TECHNICAL TALENTS TO MAKE THE PURCHASE PRACTICAL.

SEND FOR THE LATEST "BARGAIN HUNTER" BROCHURE - IT'S FREE!

SCIENTISTS/ENGINEERS MATHEMATICIANS/STUDENTS

NOW . . . there's a hand-held electronic slide rule that's really affordable . . . with performance features equivalent to others costing much more.

- Transcendental functions sin, cos, tan, $\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$, log (common logarithm), ln, (natural logarithm), e^x, x^y
- Basic functions +, −, ÷, ×
- Additional functions $\sqrt{x}$, $1/x$, x^2
- Calculation range: 1×10^{-99} and $(10-10^{-9}) \times 10^{99}$
- Displays up to 10 digit precision for mantissa and 2 digits for exponent plus signs
- π key
- Factor reversal (X Y) key
- Light to indicate radian mode
- Separate memory key for storage of intermediate results or constants
- Change sign key
- Automatic selection of floating point or scientific notation for result display
- Minus sign, overflow, and low battery indicators
- Size: 6¼" x 3½" x 1-3/16"
- Power system: Ni Cad rechargeable battery
- Weighs 10½ ozs. including batteries
- Warranty: One year parts and labor

MADE IN U.S.A.

Price: $149.95

Features

- 14 scientific functions
- 37 keys
- Trigonometric functions performed using degree or radian entry
- Algebraic problem entry
- Solves complex problems involving up to two levels of parenthesis
- Solves problems in minutes that take hours with a slide rule

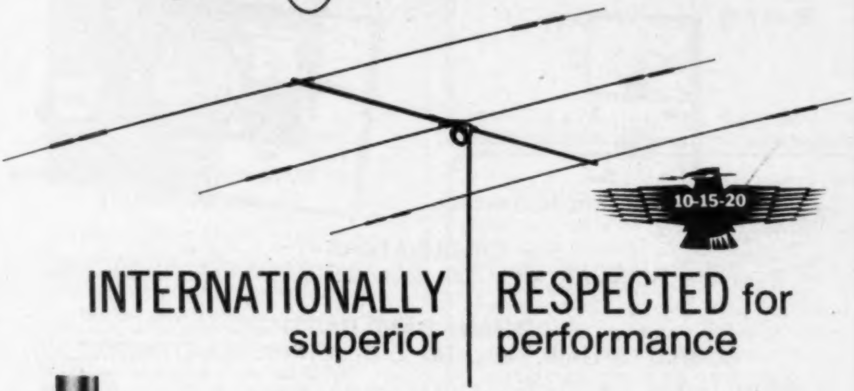
- Single function keys help eliminate ambiguity in operation
- Performs full chain calculations with any sequence of functions
- Error and low battery indicators
- Separate system clear and clear entry keys
- Accuracy is orders of magnitude better than slide rule

- All solid state electronics
- Bright, readable solid state display (light emitting diode)
- Display automatically cuts off after inactive period — extends battery life
- Full floating decimal
- Operates on rechargeable batteries or AC — use it anywhere

TECO a subsidiary of Tucker Electronics Co.
P.O. BOX 1050 1717 S. Jupiter Rd. GARLAND, TX. 75040
214—348-1560

The most popular three band beam in the world!

hy-gain TH3Mk3



10-15-20

INTERNATIONALLY superior | RESPECTED for performance

Superior construction and performance make the difference in Hy-Gain's popular 3-element Thunderbird.

- Thunderbird's "Hy-Q" traps provide separate traps for each band. "Hy-Q" traps are electronically tuned at the factory to perform better at any frequency in the band—either phone or CW. And you can tune the antenna, using charts supplied in the manual, to substantially outperform any other antennas made.
- Thunderbird's superior construction includes a new, cast aluminum, tilt-head universal boom-to-mast bracket that accommodates masts from 1¼" to 2½". Allows easy tilting for installation, maintenance and tuning and provides mast feed-thru for beam stacking.

  Taper swaged, slotted tubing on all elements allows easy adjustment and re-adjustment. Taper swaged to permit larger diameter tubing where it counts! And less wind loading. Full circumference compression clamps are mechanically and electrically superior to self-tapping metal screws.
- Thunderbird's exclusive Beta Match achieves balanced input, optimum matching on all 3 bands and provides DC ground to eliminate precipitation static.
- Up to 8 db gain
- 25 db front to back ratio
- Power capability 1Kw AM, 2Kw PEP
- SWR less than 2:1
- Extra heavy gauge, machine formed, element to boom brackets with plastic sleeves used only for insulation. Bracket design allows full mechanical support.

Model 388 $169.95

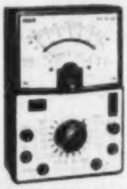
Other tri-band beams to choose from:

• 6-element Super Thunderbird TH6DXX	**Model 389**	**$199.95**
• 3-element Thunderbird Jr. TH3JR	**Model 221**	**$119.95**
• 2-element Thunderbird TH2Mk3	**Model 390**	**$109.95**

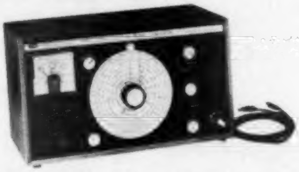
TECO a subsidiary of Tucker Electronics Co.
SURPLUS TEST EQUIPMENT FOR BARGAIN HUNTERS
P.O. BOX 1050-A 322 KIRBY ST. GARLAND, TX. 75040

TECO

A SUBSIDIARY OF TUCKER ELECTRONICS CO.



NEW RCA METERS AT SPECIAL TECO SAVINGS



UP TO 15% OFF ON ALL B&K/DYNASCAN NEW INSTRUMENTS

— CALCULATORS —
CORVUS, BOWMAR, MELCOR, SINCLAIR (WE TAKE TRADE-INS)

— CITIZENS BAND RADIO —
COBRA, HY-GAIN, MIDLAND, E. F. JOHNSON, & OTHERS

— AMATUER RADIOS —
GENAVE, MIDLAND, TEN-TEC, HY-GAIN, & MANY OTHER MODELS

— ANTENNAS —
ANTENNA SPECIALISTS, CUSHCRAFT, HY-GAIN, ROHN, CDE, & MORE

— NEW TEST EQUIPMENT —
B&K/DYNASAN, LEADER, PHILLIPS, WESTON, FLUKE, RCA, & OTHERS

— USED TEST EQUIPMENT —
HEWLETT-PACKARD, TEKTRONIX, GENERAL RADIO, FLUKE, & OTHERS

— COMPONENTS —
WORKMAN, G-C (CALECTRO), RCA, GOLD LINE, & MANY MORE

— TECHNICAL PUBLICATIONS —
SAMS' BOOKS, TAB BOOKS, ARRL BOOKS, HAM RADIO, '73, CQ, ETC.

Dick McDonald, K5WOR
CALL: (214) 348-1560
WRITE: PO BOX 1050, GARLAND, TEXAS 75040

TECO a subsidiary of Tucker Electronics Co.
P.O. BOX 1050 1717 S. Jupiter Rd. GARLAND, TX. 75040
214—348-1560

1974 WORLD repeater ATLAS

Listing by state
1974
the atlas of
FM
REPEATERS
For The Entire World

Now that most repeaters have been relicensed and hundreds of new repeaters are on the air, get this, the most complete list of repeaters available anywhere, and be sure to have it in your glove compartment when you travel, or with you when you fly so you know which repeaters to use.

This new 1974 edition of the Repeater Atlas of all the repeaters in the world is just off the press. This edition, with the monthly repeater update in the 73 newspages, will keep you posted.

1974 Repeater Atlas of the World ▪▪▪ ***ONLY***
$1.50

73 Magazine ▪ Peterborough NH — 03458

FM Schematic Digest

A COLLECTION OF
MOTOROLA SCHEMATICS
Alignment, Crystal, and Technical Notes
covering 1947-1960
136 pages 11½" x 17" ppd $6.50

S. Wolf
Box 535
Lexington, MA 02173

TOOLS

Assorted Needle Nose and Cutters. 4½ to 6" sizes. Ideal for P.C. work. (Perfect for Christmas Gift) American Made. Specify Sizes preferred or General Assortment. Send **$17.50** for assortment of 10.

GREENE'S ELECTRONICS
P.O. BOX 626
ST. GEORGE SC 29477
Phone: 803-563-3148

NEW TECHNIQUE LETS YOU LEARN NOVICE THEORY FAST!

You learn faster by listening than reading because you can play a cassette tape over and over in your spare time — even while you are driving — getting a little more each time you hear it.

You can't progress without solid fundamentals — and these four cassettes (four hours) will give you all of the basics you'll need to pass the Novice exam easily. The exam these days changes so fast you can't memorize for it any more — plus you'll have an understanding of the basics which will be invaluable for the rest of your life.

There are three one hour cassettes of theory explained by Wayne Green and one hour of questions and answers from the very latest Novice exams.

These tapes are being used by many radio clubs as an introduction to radio and electronic theory.

You'll be astounded at how really simple the theory is when you hear it explained on these tapes. Nine year old children have used these cassettes to breeze through their Novice exam.

Most cassette tapes these days sell for around $6. Since 73 is interested in helping get more amateurs and not in being in the tape business, these tapes are being sold for the incredible price of $13.95 for the complete set of four one hour cassettes — and these will play on any cassette player . . . portable, car or cassette deck.

73 MAGAZINE Peterborough NH 03458

MINIATURE SUB–AUDIBLE TONE ENCODER

- Compatible with all sub-audible tone systems such as Private Line, Channel Guard, Quiet Channel, etc.
- Glass Epoxy PCB, silicon transistors, and tantalum electrolytics used throughout
- Any miniature dual coil contactless reed may be used (Motorola TLN6824A, TLN6709B – Bramco RF-20)
- Powered by 12vdc @3ma
- Use on any tone frequency 67Hz to 250Hz
- Miniature in size 2.5x.75x1.5" high
- Wired and tested $14.95
- Complete less reed (Available in 33 freqs. for $17.50 ea)
- Output 3v RMS sinewave, low distortion
- Postpaid – Calif. residents add 5% sales tax

COMMUNICATIONS SPECIALISTS
P.O. Box 153, Brea CA 92621

Keyer Module

Control Signal Co
AKM-25

$40

This new, low-cost, two-ounce keyer module has full squeeze or normal operation, yet draws less than one ma., key down! Attach a 9v transistor battery and forget it! Has dot, dash and space memories. Use with any key lever and 4 to 15 vdc source. Write or call for brochure. (303)794-7234. Dealer inquiries invited.

CONTROL SIGNAL CO

Would You Believe 187,000 Phone Patches?

Martin W. Krey K7NZA
7037 East Chaparral Road
Scottsdale AZ 85253

Some fine volunteer phone patch operations are going to bite the dust. The persistent winding down of American military involvement in Southeast Asia and the continuing homeward parade of servicemen are good indicators of the declining need for family communications between the U.S.A. and the Thailand area. It's a safe bet that with the need for their services gone, the groups providing the phone patch hookups stateside will disband, or change their equipment and operation so much as to be unrecognizable as the organization of Viet Nam conflict vintage.

Before the big change is made, one ham decided to record as much as possible of the nature and spirit of one of the most successful patch outfits in the land, Bash-Hal-Ne-Ae. That's Navajo for "Metal that talks, sees and listens," and it's part of Ben-Nun-I-Kin; Navajo for "House on the Hill." Bash-Hal-Ne-Ae is a club station with 34 members, and it's owned by a guy described by an old friend as being "as common and down to earth as a dirt farmer." His main QTH is in Scottsdale, Arizona, and he's Barry Goldwater K7UGA.

Bash-Hal-Ne-Ae is known on the air as AFA7UGA, and according to Doris Counts, club secretary, the club began Air Force MARS service in August of 1967. Since that time, she says, the members have completed well over 187,000 phone patches for Airmen in the Viet Nam-Thailand-Philippines area. The club was organized solely to perform this service.

To visit Bash-Hal-Ne-Ae, you've got to get permission from the new head honcho, Tom Moore W7FCQ. (Bill Eccles K7MJC, well known manager for seven years recently retired due to illness.) The shack is just a few steps outside Senator Goldwater's back door, and while he is described as a very friendly guy, he doesn't want so many people up there that his grandchildren get trampled on their way to the swimming pool. Once you get inside Barry's shack, you will agree that it is one of the most far-out ham hangouts in existence.

First off, if Tom Moore or one of the other hams is inside chasing AIA8NA at Makhon Phanom, or one of the other seven Air Force MARS stations in Thailand all over the allotted frequencies, you won't make it inside the locked door. Nobody will hear you pounding. That means you're going to have to sit outside that beautiful stone shack in a stretchy relaxing chair and look out over a sparkling swimming pool, let your eyes take in the gorgeous homes and sprawling churches all around below you, and lay your eyeballs on serene desert mountain peaks such as Pinnacle Peak, Squaw Peak, and the famous Superstitions and other mountains that ring the Valley of the Sun. You can drink in great lungfuls of pure desert air and look up into a sky that is sparkling, bright and clear.

But you won't sit for long. Eagle-eyed Clarence Gartman will bear down upon you like he just caught you stealing the knob off the front door. You've blinked an electric

How can you ever get the whole membership of a club together? Here are 24 of the 38 Bash-Hal-Ne-Ae members. That's Barry Goldwater third from left in front and long-time station manager Bill Eccles first from the left. Husband and wife team of MARS members is Barbara Chamberlin WA7UHP, front center, and Bob WA7EIG. Group has completed over 187,000 phone patches for Airmen in Southeast Asia.

eye on the way in, and the grim caretaker has been sorting out your characteristics from inside the main house beyond the pool. He sees a strange car – no stars on the license plate – a droopy-shouldered guy with eyes glazed from hamming all night. You're gonna get bounced, unless you can prove that someone inside wants you in. Then out pops a key, and Clarence lets his face wrinkle into a grin, and his eyes twinkle. You're inside.

The first thing you see is the friendly face of Tom Moore, Dave Pollard WA7OVH, or one of the other club members behind the mike turning knobs or gently reminding an emotional wife in Brooklyn or Miami that

PHOTO ETCH PRINTED CIRCUIT KIT
MAKES PRINTED CIRCUITS THREE WAYS!

1 FULL SCALE ARTWORK MASTER

2 MAGAZINE ART ILLUSTRATION ➡ FILM POSITIVE ➡ NEGATIVE ➡ DEVELOPED PHOTO RESIST IMAGE ON COPPER CLAD CIRCUIT BOARD ➡ ETCHED CIRCUIT BOARD

3 DIRECT ETCH DRY TRANSFERS APPLIED TO COPPER CLAD BOARD

NO CAMERA
DARKROOM
FILM CUTTING
TRACING

USES DATAK'S POS-NEG PROCESS
The revolutionary photographic way that makes PERFECT printed circuits from original art or a printed page.

KIT CONTAINS: 5" x 6" steel printing frame. 4 sheets 5" x 6" photocopy film. yellow filter. chemicals for 1 pint film developer and 1 pint film fixer. 5" x 6" copper clad board. 3" x 4½" copper clad board. spray can of photo etch resist. 1 pint resist developer. 2 sheets 8½" x 11" layout film. 1 roll 1/16" printed circuit tape. 1 roll 1/32" printed circuit tape. 8 sheets dry transfer direct etch PC patterns including pads. transistors. round can and flat pack ICs. DIP ICs. edge card connectors. lines. circles. jogs. etc., ¼ lb anhydrous ferric chloride to make 1 pint etchant. instructions.

ER-4 COMPLETE PHOTO ETCH SET . . . . postpaid $24.95
AT YOUR DISTRIBUTOR OR DIRECT (N. J. residents add sales tax)

The DATAK corp. • 65 71st St. • Guttenberg, N. J. 07093

Tom Moore W7FCQ, station manager at Goldwater's Bash-Hal-Ne-Ae MARS station, wonders why they can't hear him in Thailand. Take heart, novices, for after checking the scope, this fine ham found he hadn't flipped the switch on the T-12 amplifier.

she's got to say "over" so that the radio hams can flip the switches to let her husband in Thailand or the Philippines talk.

Your eye quickly takes in the Robot slow scan television equipment and the double bank of Collins S-Line ham gear that is set in a gleaming wooden walk-in cabinet built by Elmer Olsen K7GPZ before he became a silent key two years ago. You note the S-1 and T-12 amplifiers, the Tektronix RM-15 scope, and the digital Heathkit frequency indicator. You see the airplane pedal foot controls for transmitters and receivers and the row of weather instruments indicating air temperature, pressure, wind direction, etc.

A picture of Kenny Hinderleiter K7HQF stands on a shelf above the weather instruments. He's the ham, blind since age fifteen months, who has run over a hundred thousand phone patches for servicemen, and whom the Air Force flew to Okinawa and feted in 1971.

Your eye becomes aware of a vast array of art treasures and trophies that cover the walls of the shack. Forty colorful Kachina dolls pop out from the stones of the fireplace, forty sacred and valuable manifestations of the Hopi gods, given to Barry by Indian friends. The dolls are the remnant of a 400-doll collection that Barry gave to the Heard Museum. Over the fireplace is a color enlargement of an Indian photograph, a study of a pensive Indian woman's face.

A long, built-in, cushioned bench fits under a row of picture windows on the north wall, looking out upon the length of Mummy Mountain. Above it is a collection of Air Force shoulder insignias.

Awards and plaques cover the walls even behind the ham gear cabinet. The north wall beside the picture windows is perhaps the most striking, for it bears a pencil sketch of a youthful Goldwater, surrounded by hundreds of signatures. It bears a dateline of 1960, Waldorf Astoria and the letters CSSC. Around the picture are autographed pictures of Presidents Kennedy, Johnson, Nixon, Eisenhower and Hoover. Jimmy Doolittle and Eddie Rickenbacker are there, as well as generals Spatz, MacArthur, Twining, LeMay, Mark Clark and many others. Even the Duke of Windsor has his picture there.

Right under this display is a low refrigerator for cold refreshments and a setup for making hot drinks. Visiting hams are invited to partake.

A ten-foot bookcase reaches nearly to the ceiling left of the door, and a quick glance tells you that the OM who owns them has a mind that likes to poke into many corners of knowledge. Among the hundreds of books are Buckley's *Eye of the Hurricane*, White's *Christ and Satan*, Lasky's *J.F.K.*, and Copley and Pourade's *Anza Conquers the Desert.*

To the right of the door another wall is covered by plaques and awards, all given to Goldwater. There is a YMCA Distinguished Service Award, and Inspiring Leadership Certificate from the Republican Conference, 88th Congress, two honorary doctor of laws degrees, and two Goldwater golden dollars, with his face on one side and the Liberty Bell on the other. The whole wall is covered.

But this is primarily a MARS station, so in the most obvious places, right over the ham gear, Senator Goldwater has placed the awards and certificates earned by the men and women who belong to the club and are responsible for its remarkable DX phone patch record. There's a certificate from Air Force Communications dated October 12, 1968, showing appreciation to AFA7UGA hams for running 10,000 phone patches for soldiers in Southeast Asia. Another dated July 15, 1970, is a Certificate of Achievement from the Department of Defense,

wanted YOUR GEAR . . .

We pay top dollar or trade . . .

Tell us what you have — Here's a partial list of what we want:

RT-742/ARC-51BX* . . RT-662/GRC-106
**w/control boxes*
RT-743/ARC-51A . . . RT-698/ARC-102
RT-823/ARC-131 . . . Magnavox FM-622
RT-857/ARC-134 . . . RT-859/APX-72 .
RT-524/VRC . . . RT-246/VRC . . . .
R-442/VRC . . . R-390A/URR . . .
RT-648/ARC-94 . . . AN/TRC-68 . . . . .
AN/VRC-24 . . AN/URC-9 . . AN/PRC-77
CU-1669/AR . . . 490T-1 . . . 618T-1-2-3
C-6287/ARC-51BX . . . AN/PRC-25 . . .
Wilcox 807 . . AN/ARC-114/115/116 . . .

We buy all types of military test equipment . . . radios, etc. Do you have a TS—683/TSM crystal impedance meter, H—P or TEKTRONIX equipment? If you hate $$$ we'll trade for NEW ham gear! But if you love green stuff, let's trade YOUR equipment for OUR dough!

COLUMBIA ELECTRONIC SALES, INC.
Box 9266—A; No. Hollywood, CA 91609
Phone: (213) 764-9030

8038C VCO WAVEFORM GENERATOR
New, factory parts, full specs. 14 pin DIP. $5.75, 2/$10.50

LM566CH VCO FUNCTION GENERATOR
New, TO-5, specs. $4.00

MC 1455(555) PRECISION TIMER
New,Mini—Dip $1.65

MM5314 CLOCK CHIP
New, full specs $9.50

8220 MEMORY
8 bit (4x2) content addressable memory. TTL and DTL compatible. For use in DATA—TO— MEMORY camparison, pattern recognition, cache memory, auto correlation, virtual memory, learning memory. New, House numbered. 16 pin DIP, specs.
$6.00, 10/$45.00

VOLTAGE REGULATORS
MFC 6034, variable to +20V, 200mA $1.00
ML 7805, 7806, 7812, 7815, 7824, pos.voltage, 1A $2.50
MC 7912, 7915 neg.voltage, 1A $2.50
723G variable 2 to 37V, 150mA, house numbered . . . . $.70

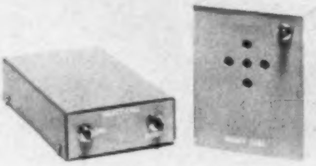
DTL SALES
930 Dual 4-input NAND GATE
946 Quad 2-input NAND GATE
962 Triple 3-input NAND GATE
$.25 each, 10/$1.75, 100/$15.00
ANY MIX

TTL SALE
New — House numbered SN7400, SN7402, SN7410, SN7430, SN7450, SN7453, SN7460
$.25 each, 10/$2.00, 100/$17.50
ANY MIX

ALL ORDERS POSTPAID — PLEASE ADD INSURANCE
MINIMUM ORDER — $5 U.S./$15 FOREIGN
LATEST LISTS — 10¢ stamp

tri-tek, inc.
P.O. BOX 14206, DEPT 7
PHOENIX, ARIZONA 85063

Select Call



TIRED OF LISTENING TO THE CHATTER ON THE CHANNEL? THEN USE SELECT CALL – RECEIVE ONLY THOSE CALLS MEANT FOR YOU!

WITH THE **SELECT CALL** DECODER YOUR RADIO REMAINS SILENT UNTIL SOMEONE SIGNALS YOU WITH THE **SELECT CALL** ENCODER. EASY TO USE. EASY TO INSTALL – CONNECTS BETWEEN YOUR RADIO AND SPEAKER.

- Easy hook-up. Speaker in, speaker out, 12 vdc
- Encoder acoustically coupled to microphone (no direct connection)
- Decoder can be set for Touchtone activation thus no need to buy encoder if Touchtone is built
- Decoder and Encoder frequency easily changed with or without frequency counter
- No falsing
- Off switch to revert to normal operations
- Narrow bandwidth
- Encoder requires no external supply

SELECT CALL DECODER KIT (Parts, board, box, switches) $29.50

Select Call decoder assembled and tested $39.50

Select Call encoder assembled and tested $11.95

Select Call encoder when purchased with decoder or decoder kit $8.95

Specify system frequency (1050 hz to 2500 hz). If not specified units will be set at 1200 hz.

Add $1.50 for postage and handling. California residence add 6% sales tax. No C.O.D.

G. Egbert
17333 Tramonto Dr.
Pacific Palisades, Ca. 90272

Dealer Inquiry Invited

Voxpoop

While we are to some extent a prisoner of the authors of the articles – if they don't write them we can't print them – still we do like to know your reaction to what we do publish so we can keep trying to bring you what you enjoy the most. In the interests of science then, please let us know which articles you enjoyed the most and which you disliked most. The author of the article with the most votes will get a check for $50 extra to encourage him to get busy and write more.

WOW!

UGH!!

VOXPOOP, 73, Peterborough NH 03458

Military Assistance Command, signed by General Creighton Abrams. Still another, from the Department of the Air Force, is for completing 100,000 phone patches between December 1965 and December 1971, signed by General John D. Ryan, Chief of Staff.

On the end of the rig cabinet, facing the door, are individual engraved name plates for the four club members who have become silent keys since the beginning of the phone patch service.

Between the rig and the long bench stands a glass-topped trophy table containing an array of pins, medalions, gavels, keys to cities, and other trophies given to K7UGA by people all over the nation. But placed prominently on top of the glass is a large, thick book of letters from soldiers, YL's, XYL's, and parents who wanted to say thanks for phone patches.

A wife in Tucson wrote in 1970, "No greater Christmas gift could I and my two children have than a call from my husband." A Houston father wrote in 1971, "My wife – in between tears – was thrilled to hear the voice of our son." An undated letter from a sergeant in the combat zone said simply, "A call to loved ones is the next best thing to being with them."

A letter from a Phoenix hospital thanks the hams for speedy contact with a doctor in Viet Nam when the postal service couldn't get the job done in two months. The writer voices surprise that the station could put the hospital person-to-person with their man so quickly "over a distance of 13,000 miles."

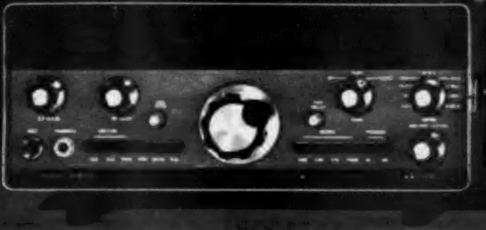
The most striking thing about the phone patch service is the apparent ease at which the whole thing is carried off. Tom Moore or another op points the Collins 237B log periodic beam toward Thailand, tunes the 32S-3 to a MARS frequency, zero beats the 75S-3C, and calls one of the stations he's recently had good, solid hook-ups with. If conditions are good, he gets a booming answer, signal reports are exchanged, the stateside ham gets a Ma Bell long distance operator on the line, and the waiting Airmen at some base in or near Thailand get to talk home.

The character of the conversations has changed since the life-or-death element has been lifted from Southeast Asian duty.

MORE THAN THREE YEARS AGO,
HEATH ENGINEERS ACCEPTED
THE CHALLENGE TO DEVELOP
A COMPLETELY NEW
APPROACH TO AMATEUR
RADIO DESIGN.

THE RESULTS SOON WILL BE
HEARD WORLD-WIDE.

THE NEW HEATHKIT SOLID-STATE TRANSCEIVER



SB-104...the most advanced design in amateur radio

All the modern circuitry, built-in features, high performance, and honest operating convenience you have wanted for years...here today.

Completely solid-state...from front end to RF output, with over 275 advanced solid-state devices, including 31 ICs, 75 transistors and 171 diodes. The result is a design that runs cooler, quieter, better, longer. The four finals are totally protected.

Totally broadbanded. The new 104 means instant QSY. You can go from CW on the low end of 80 to USB on the high end of 10 in seconds ...with perfect tune. Gone are the bothersome Preselector, Load and Tune controls. Just choose the band, dial in the operating frequency, select your mode...and go!

True digital readout. The new SB-104 provides 6 digits of large, bright, easily read frequency information...with resolution down to 100 Hz on all bands. And unlike other so-called digital readout systems that interpret just the VFO frequency, the SB-104 incorporates true digital frequency measurement circuitry that takes into account all three frequencies: VFO, HFO and BFO. What you see is where you are... always.

Total operating convenience. The front panel is clean, well-labeled and easy to use. The large spinner knob on the VFO delivers about 30 kHz per revolution. To the right of the VFO knob are controls for Drive Level, Bandswitch and the switched (Off-fast-slow) AGC to suit various operating conditions. Pushbuttons select mode (USB/LSB/CW), a Tune button for loading linear amplifiers, a Hi-Lo power switch, and Power on-off switch. On the left of the VFO knob are controls for audio and RF gain, jacks for a PTT mike and phones, and pushbuttons to monitor input DC voltage, ALC action and relative power on the front panel meter. The built-in VOX can be switched in and out with another pushbutton...and we've put the VOX gain and delay controls on the front panel, too. And, if you've installed the optional Noise Blanker, a front panel pushbutton switches it on or off.

Available December

Performance-plus! The SB-104 is more than convenient to use...it's a pleasure. The transmitter delivers a solid 100 watts *output* in the high power position; for QRPers the output can be switched to one watt instantly with the front panel pushbutton.

The broadband receiver performance is spectacular...carefully designed to minimize cross-modulation and intermodulation; active devices are kept to a minimum ahead of the highly selective crystal filter. Adjacent signal overload is negligible, yet sensitivity is better than 1 µV. And there is a 15 MHz WWV receive position on the band switch.

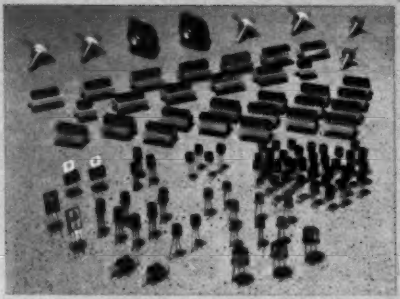
Easy assembly and alignment. We believe the new SB-104 is the most sophisticated amateur radio transceiver on the market. It has over 2800 parts, consequently it won't go together in just an evening or two, (we have averaged about 50 hours in pre-production assembly). But it does go together easily, easier than any we've ever offered. All but a handful of the components mount on one of the 15 glass epoxy boards, and two wiring harnesses eliminate most of the point-to-point wiring. Eleven of the boards plug-in for easier assembly, and 7 of them can be extended out of the chassis.

And still more features! The SB-104 will operate directly from a 12V automobile electrical system. For fixed station use, just hook-up the new HP-1144 supply. Complete back panel inputs and outputs...see feature photo on right page. And, we've even designed-in a place on the readout panel where you can light up your call sign when you build the SB-104...we give you all the letters and numbers you need to do it.

This is the transceiver you'll be hearing world-wide. Years ahead of every other...at any price. The SB-104...it belongs at your operating position.

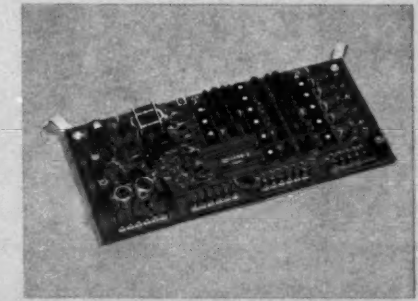
Kit SB-104, 31 lbs.	669.95
Kit SBA-104-1, Noise Blanker, 1 lb., mailable	24.95
Kit SBA-104-2, Mobile mount with hinged rear, telescoping front support, 11' cable, power relay, and circuit breaker, 6 lbs., mailable.	$34.95
Kit SBA-104-3, 400 Hz CW crystal filter, 1 lb., mailable	34.95

CHECK THESE ADVANCE DESIGN FEATURES:

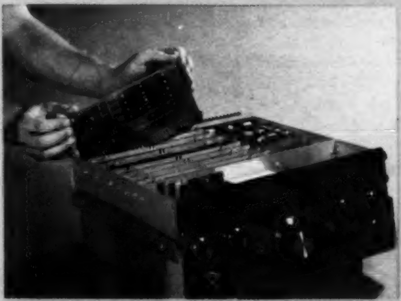


Completely solid-state design...including the finals. Over 275 solid-state devices, including 31 integrated circuits. ***The SB-104 output board and final transistors are warranted for one full year***

True digital readout. Six ½" gas-discharge displays deliver resolution down to 100 Hz with across-the-room visibility.

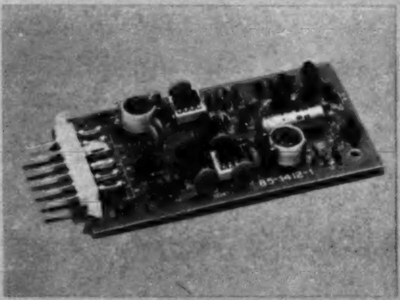


Completely broadbanded. Neither the transmitter nor receiver sections require tuning from 3 to 30 MHz...instant QSY from 80 to 10 meters is a reality.



Circuit board construction. Most components mount on 15 circuit boards for easy assembly. The seven major boards can be extended out of the chassis for adjustment or troubleshooting while rig is operating.

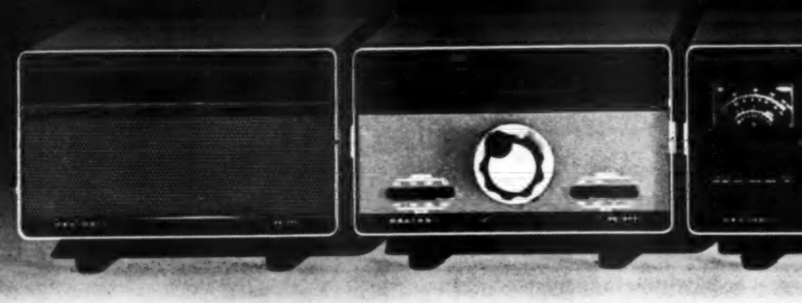
Complete back-panel connections: Phone patch in & out; auxiliary audio input; speaker; key; ALC; VFO in & out; driver out; IF out; accessory plug; power plug; two spare jacks; separate transmit & receive antenna jacks.



New noise blanker plugs into SB-104 & solves the ignition noise problem. Provides up to 50 dB of effective blanking. Rep rate 10 to 2000 pulses/sec.; pulse widths 1 to 250 µsec.

LIFT

NEW SYSTEM-ENGINEE

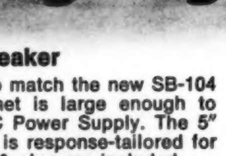


SB-604 Station Speaker

Designed and styled to match the new SB-104 Transceiver, the cabinet is large enough to house the HP-1144 AC Power Supply. The 5" x 7", 3.2 ohm speaker is response-tailored for SSB. Connector cable & plug are included.

Kit SB-604, Speaker & cabinet,
8 lbs., mailable 29.95

HP-1144 Fixed-Station AC Power Supply



This new 120 V/240 VAC operated supply provides the 13.8 VDC required by the new SB-104 Transceiver. The full-wave bridge circuit has triple Darlington regulation with an integrated circuit which samples, compares, and automatically adjusts transistor bias to maintain a fixed output level. Output is remotely sampled at the load end of the power cable, thereby compensating for voltage drop across fuse and cable, to provide almost no change in voltage from no load to full load conditions. A cable and socket provide output power and a series connection to the SB-104 remote on-off switch. The generous heat sink fits on the back of the supply, and the entire unit may be mounted within the SB-604 speaker cabinet.

Kit HP-1144, fixed-station supply,
28 lbs., mailable 89.95

SB-634 Station Console

Five station accessories in one!

24-hour digital clock: six half-inch gas discharge digits indicate hours, minutes and seconds. The clock runs continuously, as long as the console is plugged in.

Ten-minute ID timer: Three gas discharge digits indicate minutes and seconds up to 9:59. At ten minutes the timer recycles and provides either a visual alarm or both visual and audible alarms. Pushbutton zero reset.

RF wattmeter: The big meter delive
ing capability of either 200 watts o
full scale. 160 through 10 meters.

SWR bridge: Push a button to me
Separate front panel SWR sensiti

Phone patch: The hybrid patch c
either manually or with VOX con
switching connections. VU capab
meter and separate front panel co
just transmitter and receiver gai
ently. Line isolation can be adjuste
panel control.

Kit SB-634, 14 lbs. ....

SB-644 Remote VFO

Designed exclusively for the new S
new SB-644 provides serious DXer
useful split transmit/receive capa
the "104/644" combination, you
quency limited in any way — the
can be at one end of the band, the
at the other end.

Multi-mode capability. The "644" a
ceive operation on either itself or
transmit on the "104" and receive c
... receive on the "104" and tran
"644". And you can use either of t
tal positions in the "644" for fixe
control.

Easy pushbutton operation. Front
buttons on the "644" control all
transmit and receive modes on bo
and the remote VFO. No switching c
is necessary. Status lamps behind
indicate frequency-control mode.

Digital readout in the SB-104. A
SB-644 includes a linear dial on it
to get you into the right frequency
frequency readout takes place in
The display automatically change
rect frequency as you go from tra
ceive.

Kit-built VFO. The "644" uses the s
as the new SB-104. And thanks
digital frequency readout in the
cern about dial VFO linearity pr
thing of the past. If you work ser
your new SB-104, you'll want the

Kit SB-644, 10 lbs. ....

EERED SOLID-STATE ACCESSORIES

delivers measur-
tts or 2000 watts
ers.

o measure SWR.
ensitivity control.

ch can be used
control without
apability on the
el controls to ad-
gain independ-
justed with a rear

..........179.95

new SB-104. The
DXers with really
capability. With
you aren't fre-
— the transceiver
, the remote VFO

644" allows trans-
lf or the "104"...
eive on the "644"
transmit on the
r of the two crys-
r fixed-frequency

Front panel push-
ol all transceive,
on both the "104"
hing on the "104"
ehind the window
ode.

04. Although the
on its front panel
ency area, actual
ce in the "104".
anges to the cor-
m transmit to re-

the same kit VFO
anks to the true
the "104", con-
ity problems is a
k serious DX with
nt the new "644".

............119.95

SB-614 Station Monitor

How clean is your signal? With the SB-614, you'll know. It monitors transmitted SSB, CW, and AM signals up to 1 kW from 80 — 6 meters. The highly visible 1½ x 2" CRT, with push-pull drive for a keystone-free, sharp, clean trace, indicates a wide variety of common operating problems. non-linearity, insufficient or excessive drive, poor carrier or sideband suppression, regeneration, parasitics and CW key clicks. The manual includes 40 CRT display illustrations and explanations.

Complete controls. All standard scope control functions are available in the "614"...Vertical Gain & Position, Horizontal Gain & Position, Focus, Mode (SSB, Trapezoid & Cross for RTTY Mark/Space adjustments). The improved recurrent, automatic sync-type sweep generator is adjustable in three ranges from 10 Hz to 10 kHz. Front panel control gives 11 steps of attenuation. For limited test applications the "614" can be used as a normal scope, and provides 10 Hz to 50 kHz bandwidth, good sync and high input sensitivity. A rear panel 10:1 vertical attenuator provides extra convenience.

Additional features include all solid-state design; rear panel Astigmatism control; standard horizontal and vertical inputs for use as a scope; exciter and linear inputs/outputs. Circuit board/wiring harness design makes assembly fast and easy. What kind of signal do you have? Order your new SB-614 today and know.

Kit SB-614, 17 lbs. 139.95

SB-230 Conduction-Cooled 1 KW Linear

Strong and silent. The new "230" uses a husky Eimac 8873 triode in proven, stable, grounded grid circuitry to deliver up to 1200 watts PEP SSB, 1000 watts CW input from less than 100 watts drive. And the "230" is also rated at 400 watts input for slow-scan TV and RTTY. A massive heat sink eliminates the need for a fan.

Complete operating convenience. On the front panel of the new SB-series low profile cabinet you'll find all controls at your fingertips for easy operating. Bandswitching is done with a single knob...Load and Tune controls are clearly marked. Full metering facilities.

A full complement of built-in safety features. The cabinet features microswitch interlocks on both the top and bottom to shut down the primary power when the cabinet shells are removed. Front panel status lights indicate Hi Temp, Exciter and Delay. The heat sink for the 8873 is temperature monitored; if the temperature rises too high, a thermal circuit breaker opens, the linear shuts down and the Hi Temp light goes on. The Exciter light indicates that the linear is running straight through, without amplification. To allow the tube sufficient time to warm up, a delay circuit is built-in. When warm-up is completed, the Delay light goes out. The On-Off switch also includes a built-in circuit breaker for the primary side of the power transformer. And the cathode of the tube is fused for additional protection.

Easy assembly. The new SB-230 goes together in 15 to 20 hours. No alignment is necessary.

The new SB-230, styled to match the SB-104 transceiver, delivers all the features and performance you've come to expect from Heath. We think you will agree it's the greatest value in modern linears.

Kit SB-230, 40 lbs. 319.95

GET FULL DETAILS
Send for the new FREE
1975 Heathkit Catalog.

HEATH COMPANY, Dept. 11-11
Benton Harbor, Michigan 49022

HEATH
Schlumberger

Please rush my FREE Heathkit Catalog.

Name ____________________

Address ____________________

City __________ State __________ Zip __________

*Mail order prices; F.O.B. factory
Prices & specifications subject to change without notice.

SS-103

SPECIFICATIONS

SB-104 SPECIFICATIONS — TRANSCEIVER SECTION — GENERAL OPERATION: Frequency Coverage: 3.5 MHz through 29.7 MHz amateur bands, 15 MHz WWV receive only. **Frequency Stability:** Less than 100 Hz/hr drift after 30-min. warmup; less than 100 Hz drift for ±10% change in primary voltage. **Modes of Operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Readout Accuracy:** Within ±200 Hz ±1 count. **Audio Frequency Response:** 350 to 2450 Hz ±75 Hz (6 dB bandwidth). **Dial Backlash:** 50 Hz max. **Phone Patch Impedance:** 4 ohm output to speaker; high impedance output to transmitter. **Power Requirements:** 13.8 VDC nominal (max. 16 VDC) at: Receive: 2 amp. Transmit: low power: 3 amps.; hign power: 20 amps. **TRANSMITTER: RF Power Output: High Power** (50 ohm non-reactive lead). SSB: 100 watts PEP ±1 dB; CW: 100 watts ±1 dB. **Low Power** SSB: 1 watt PEP (minimum); CW: 1 watt (minimum). **Output Impedance:** 50 ohms, less than 2:1 SWR. **Carrier Suppression and Unwanted Sideband Suppression:** 55 dB down from 100 watt single-tone output at 1000 Hz reference. **Harmonic Radiation:** 45 dB below 100 watt output. **Spurious Radiation:** —50 dB within ±3 MHz of carrier; —60 dB farther than ±3 MHz from carrier, except —40 dB at 3.39 MHz on 80 meter band. **Third Order Distortion:** 30 dB down from two-tone output, reference at 100 watts PEP. **Transmit/Receive Operation:** SSB: PTT or VOX; CW: Keyed-tone VOX or manual. **CW Side-Tone:** Internally switched to speaker or headphones in CW mode. Approximately 700 Hz tone. **Microphone Input:** High impedance with a rating of —45 to —55 dB; approx. 25K ohms to match Heath desk-type microphone. **RECEIVER — Sensitivity:** Less than 1.0 microvolt for 10 dB signal-plus-noise-to-noise ratio for SSB operation. **Selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down. (2:1 nominal shape factor). **CW Selectivity:** (with accessory CW filter) 400 Hz at 6 dB down; 2 kHz max. at 60 dB down. **Overall Gain:** Less than 1 microvolt for 0.5 watt audio output. **Audio Output:** 2.5 watts into 4 ohms, 1.25 watts into 8 ohms, at less than 10% THD. Low impedance headphones (4-8 ohm). **AGC:** Less than 1 millisecond attack time; switch selectable 100 μsec. and 1 msec. release, and OFF. **Intermodulation Distortion:** —65 dB min. **Image Rejection:** —60 dB min. **IF Rejection:** —60 dB min. **Internally Generated Spurious:** Below 2 microvolt equivalent antenna input, except at 3.65, 3.74, and 21.2 MHz. **MECHANICAL — Front Panel Controls/Switches:** AGC — Off, Slow, Fast; AF Gain; Microphone Jack; Headphone Jack; Main Tuning; Mic/CW Level; Vox Gain; Vox Delay; Band Switch. **Pushbuttons:** ALC (Meter); 13.8V (Meter); Relative Power (Meter); 100 Hz (Disable); Noise Blanker (On/Off); LSB (Mode); USB (Mode); CW (Mode); Tune; Hi/Lo (Power Select); VOX (On/Off); PWR (On/Off). **Rear Panel Controls/Sockets:** Anti-Trip; Sidetone Level; Linear Amplifier ALC Input; Phone Patch Input; Phone Patch Output; Key (CW) Input; Speaker (4 ohm) Output; Spare (2); Receiver Audio Input; VFO Input; VFO Output; IF Output; Driver Output; Ground Post; Power Plug; Accessory Socket (includes relay output); Antenna Input; Receiver Antenna Input; Common/Separate Antenna Switch. **Dimensions:** 5¾″ H x 14 15/16″ W x 13⅞″ D. (Less knobs, feet and connectors). **Weight:** 20 lbs.

The SB-104 output board and final transistors are warranted for one full year.

HP-1144 SPECIFICATIONS — Output Voltage: 13.8 VDC regulated (Adjustable from approximately 11 to 16 VDC). **Maximum Output Current:** 20 amperes, Intermittent. 8 amps continuous. **Transistor Integrated Circuit and Diode Complement:** 2N3643 transistor; 2N3055 transistor; 40411 pass transistor (2); MFC6030 regulator IC; 1N4002 silicon diode; MDA990-2 bridge rectifier. **Power Requirements:** 110 to 130 VAC @ 6A or 220 to 260 VAC @ 3A, 50/60 Hz maximum. **Dimensions:** 5½″ H x 9¼″ W x 10¼″ D. **Regulation:** Less than 2% output voltage variation from no load to 20 amperes. **Ripple:** Less than 1% at 20 amperes. **Fuses:** 7-amp, 3AG, slow-blow primary. 20-amp, 3AG, output. **Net Weight:** 23 lbs.

SB-604 SPECIFICATIONS — Speaker Size: 5″ x 7″ oval. **Voice Coil Impedance:** 3.2 ohms. **Frequency Response:** 300 to 3000 Hz. **Magnet Weight:** 3.16 oz. **Cabinet:** Aluminum with gray wrinkle finish. **Dimensions:** 7⅛″ H x 10⅛″ W x 14″ D.

SB-644 SPECIFICATIONS — Frequency Coverage: 5.0 — 5.5 MHz allowing 80, 40, 20, 15, 10 meter operation in the SB-104. **Frequency Stability:** Less than 100 Hz drift per hour after thirty minute warmup. **Modes of Operation:** Remote VFO; Main VFO; Receive Remote/Transmit Main; Receive Main/Transmit Remote; Crystal frequencies (2) (crystals not supplied). **Dial Backlash:** 100 cycles max. **Power Requirements:** 11V and 13.6V at 500 mA from the SB-104. **RF Output:** 0.34 to 0.4V RMS over 5 to 5.5 MHz into a 50 ohm load.

SB-634 SPECIFICATIONS — CLOCK — Display: Six full digits. **Time Base:** 24 hours. **Accuracy:** Determined by accuracy of power line frequency. **TIMER — Display:** Three full digits. **Time Interval:** 10 minutes with automatic reset. Manual reset at any portion of 10-minute period. **Accuracy:** Determined by accuracy of power line frequency. **Signal:** Visual only or both visual and aural; switch selected. **RF POWER/SWR METER — Frequency Range:** 1.8 to 30 MHz. **Wattmeter Accuracy:** ±10% of full-scale reading. **Power Handling Capability:** 2000 watts (maximum). **SWR Sensitivity:** Less than 10 watts. **Impedance:** 50 ohm nominal. **SWR Bridge:** Continuous to 2000 watts P.P. **Connecters:** UHF type SO-239. **PHONE PATCH — Circuit:** Telephone hybrid circuit. Allows voice control or manual operation. **TELEPHONE LINES — Input Impedance:** Approximately 600 ohm. **Null Depth:** At least 30 dB isolation between transmit and receive circuits. **Receiver Impedance:** Effective match from 3 to 16 ohm. **Transmitter Impedance:** 600 ohm or higher impedance output. **GENERAL — Meter:** 100μA movement. VU readings for phone patch monitoring. Null depth indication. RF power output, relative power, and SWR readings. **FRONT PANEL CONTROLS — Timer:** Off, Visual, Aural Visual. **Reset:** Pushbutton switch. **Patch Gain:** Transmitter, Receiver. **SWR:** Sensitivity. **Mode:** SWR, Forward and Reflected. 2000 W and 200 W. Phone Patch. **Rear Panel Controls — Clock:** Time hold, minutes set, seconds set. Null Adjust control; Null-Monitor switch; C adjust control; R adjust control. **Power Requirements:** 120/240 VAC, 50/60 Hz, 15 watts.

SB-614 SPECIFICATIONS — RF SAMPLING SECTION: Frequency Coverage: 80 through 6 meters (3.5 — 54 MHz). **RF Power Limits:** Exciter input (50 — 75 ohm) 10 to 300 watts; Antenna input (50 — 75 ohm) 10 to 1000 watts (up to 1500W PEP). **Insertion Loss:** Negligible. **VERTICAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 75 pf. **Sensitivity:** 60 mV rms/¼″ vertical deflection. **Attenuator:** 2 position; x1, 2 volts rms max. input; x10, 20 volts rms max. input. **Frequency Response:** 10 Hz to 50 kHz ±3 db. **HORIZONTAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 50 pf. **Sensitivity:** 50 mV rms/¼″ horizontal deflection. **Frequency Response:** 10 Hz to 3 MHz ±3 dB. **SWEEP GENERATION: Type:** Recurrent, automatic sync. **Frequency Range:** 10 Hz to 10 kHz in three ranges. **GENERAL: CRT:** 3RP1/A flat face, green, medium persistence phosphor. **Graticule:** .250 inch squares 6 x 8 (1.5 x 2.0 inches total viewing area). **Power Supplies:** All solid-state rectifiers. All amplifier supplies regulated. **Power Requirements:** 110-130 or 220-260 VAC, 50/60 Hz, 35 watts. **Front Panel Controls:** Intensity — Off-on; Mode — SSB, TRAP, CROSS; Focus; Vertical Gain; Vertical Position; Horizontal Gain; Horizontal Position; Sweep — variable; Range — 100 Hz, 1 kHz, 10 kHz. **Rear Panel Controls:** Astigmatism; Vertical attenuator —X1, X10. **Rear Panel Connecters:** Antenna: SO-239; Exciter: Phono; Vertical Input: Phono; Horizontal Input: Phono. **DIMENSIONS:** 7¼″ H x 10¼″ W x 15¼″D. **Net Weight:** 12 lbs.

SB-230 SPECIFICATIONS: Band Coverage: 80, 40, 20, 15 and 10 meter amateur bands. **Maximum Power Input:** 1200 W PEP SSB; 1000 W CW; 400 watts RTTY/SSTV. **Duty Cycle: SSB:** continuous voice modulation; **CW:** continuous (max. key-down time 30 seconds); **RTTY/SSTV:** 50% (max. transmit time 10 minutes at 400 watts). **Driving Power Required:** less than 100 W. **Third Order Distortion:** —30 dB or better. **Output Impedance:** 50 ohms at 2:1 SWR max. **Input Impedance:** 52 ohms at 1.5:1 SWR max. **Meter Switch:** Exciter only; Relative Power; Plate Current; Grid Current; High Voltage. **Front Panel:** Load; Tune; **Band**; Relative Power sensitivity; Power switch; Meter switch. **Rear Panel:** ALC output; Exciter relay; RF input; RF output; Ground lug; Fuse; Line cord. **Tube:** Type 8873. **Zero signal plate current:** 25 mA. **Power Requirements:** 120 VAC, 50/60 Hz, 14 A max. 240 VAC, 50/60 Hz, 7 A max. **Dimensions:** 14¾″ W x 16″ D x 7″ H. **Net Weight:** 33½ lbs.

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

There are still tears and emotion, but much of the anxiety and assurances of safety have been replaced by information on duty changes, instructions to wives, requests for information on the kids, wifely requests for blue star saphire rings, etc.

Right now AFA7UGA is experiencing propagation problems because of the bottoming section of the eleven-year sunspot cycle, and Tom Moore has only two shifts of operators working. One starts at 4:30 a.m. and runs to 7:30 a.m.; then the other takes over and goes until the bottom falls out. Twenty-five to fifty completed patches a day is typical.

Typical, too, is the broken contact anywhere from 9:00 a.m. to noon, when the D-layers open up. "Four and a half KW's," says Tom then, "and all of it right out through the old chicken wire."

That's when he pulls the big switch and tells the sweet-voiced land-line operator, "We've been shot right out of the saddle. Better knock a couple of minutes of waiting time off that last call, and we'll buzz you tomorrow."

Then he secures the gear and the shack, ushers the nosey visitor out, and goes home to grab a bite before dashing off to work. Before he drives off, he hangs out of his car window and says, "You just can't imagine the dedication of our club members. Why, Bob Kraig W7OYC hasn't missed a Sunday in eight years. He works every Sunday from 4:30 a.m. until noon. That's the kind of participation that has made our station successful."

By the time the sunspot cycle has made MARS DX as good as an eyeball QSO again, there may be virtually no need for its Southeast Asian phone-patch services. But in case some other need arises, it's a good bet that Barry Goldwater and other shack owners will keep big books of thank you letters handy to remind them that they should keep the old bucket of bolts in good working order.

And the hams? You know they'll be ready.

. . .K7NZA

For FREQ. STABILITY

Depend on JAN Crystals. Our large stock of quartz crystal materials and components assures Fast Delivery from us.

CRYSTAL SPECIALS

2-METER FM for most Transceivers 144-148 MHz — .0025 Tol.	ea. $3.75
Frequency Standards	
100 KHz (HC 13/U)	4.50
1000 KHz (HC 6/U)	4.50
Almost all CB Sets, Tr. or Rec. (CB Synthesizer Crystal on request)	2.50
Any Amateur Band in FT-243	1.50
(80-meter, $3.00 — 160-meter not avail.)	4/$5.00

For 1st class mail, add 20c per crystal. For Airmail, add 25c. Send check or money order. No dealers, please.

JAN CRYSTALS

Division of Bob Whan
& Son Electronics, Inc
2400 Crystal Drive
Ft. Myers Florida
33901
All Phones
(813) 936-2397

Send 10c for new catalog with 12 oscillator circuits and lists of frequencies in stock

New! NOVICE CLASS STUDY GUIDE

amateur radio

Much more than a Q&A Manual. With this new book you LEARN the THEORY. So simply explained that anyone can understand it the first time through. Never has there been such a simple theory course. Be ready for that 1974 FCC Exam with this 1974 book.

Other study manuals ask you to memorize questions and answers — this one lets you learn the theory so • • •

you'll know the ANSWERS

1974 EDITION ... $4.95

73 Magazine — Peterborough NH — 03458

SPECIFICATIONS

SB-104 SPECIFICATIONS — TRANSCEIVER SECTION — GENERAL OPERATION: Frequency Coverage: 3.5 MHz through 29.7 MHz amateur bands, 15 MHz WWV receive only. **Frequency Stability:** Less than 100 Hz/hr drift after 30-min. warmup; less than 100 Hz drift for ±10% change in primary voltage. **Modes of Operation:** Selectable upper or lower sideband (suppressed carrier) and CW. **Readout Accuracy:** Within ±200 Hz ±1 count. **Audio Frequency Response:** 350 to 2450 Hz ±75 Hz (6 dB bandwidth). **Dial Backlash:** 50 Hz max. **Phone Patch Impedance:** 4 ohm output to speaker; high impedance output to transmitter. **Power Requirements:** 13.8 VDC nominal (max. 16 VDC) at: Receive: 2 amp. Transmit: low power: 3 amps.; hign power: 20 amps. **TRANSMITTER: RF Power Output: High Power** (50 ohm non-reactive load). SSB: 100 watts PEP ±1 dB; CW: 100 watts ±1 dB. **Low Power SSB:** 1 watt PEP (minimum); CW: 1 watt (minimum). **Output Impedance:** 50 ohms, less than 2:1 SWR. **Carrier Suppression and Unwanted Sideband Suppression:** 55 dB down from 100 watt single-tone output at 1000 Hz reference. **Harmonic Radiation:** 45 dB below 100 watt output. **Spurious Radiation:** −50 dB within ±3 MHz of carrier; −60 dB farther than ±3 MHz from carrier, except −40 dB at 3.39 MHz on 80 meter band. **Third Order Distortion:** 30 dB down from two-tone output, reference at 100 watts PEP. **Transmit/Receive Operation:** SSB: PTT or VOX; CW: Keyed-tone VOX or manual. **CW Side-Tone:** Internally switched to speaker or headphones in CW mode. Approximately 700 Hz tone. **Microphone Input:** High impedance with a rating of −45 to −55 dB; approx. 25K ohms to match Heath desk-type microphone. **RECEIVER — Sensitivity:** Less than 1.0 microvolt for 10 dB signal-plus-noise-to-noise ratio for SSB operation. **Selectivity:** 2.1 kHz minimum at 6 dB down, 5 kHz maximum at 60 dB down. (2:1 nominal shape factor). **CW Selectivity:** (with accessory CW filter) 400 Hz at 6 dB down; 2 kHz max. at 60 dB down. **Overall Gain:** Less than 1 microvolt for 0.5 watt audio output. **Audio Output:** 2.5 watts into 4 ohms, 1.25 watts into 8 ohms, at less than 10% THD. Low impedance headphones (4-8 ohm). **AGC:** Less than 1 millisecond attack time; switch selectable 100 μsec. and 1 msec. release, and OFF. **Intermodulation Distortion:** −65 dB min. **Image Rejection:** −60 dB min. **IF Rejection:** −60 dB min. **Internally Generated Spurious:** Below 2 microvolt equivalent antenna input, except at 3.65, 3.74, and 21.2 MHz. **MECHANICAL — Front Panel Controls/Switches:** AGC — Off, Slow, Fast; AF Gain; Microphone Jack; Headphone Jack; Main Tuning; Mic/CW Level; Vox Gain; Vox Delay; Band Switch. **Pushbuttons:** ALC (Meter); 13.8V (Meter); Relative Power (Meter); 100 Hz (Disable); Noise Blanker (On/Off); LSB (Mode); USB (Mode); CW (Mode); Tune; Hi/Lo (Power Select); VOX (On/Off); PWR (On/Off). **Rear Panel Controls/Sockets:** Anti-Trip; Sidetone Level; Linear Amplifier ALC Input; Phone Patch Input; Phone Patch Output; Key (CW) Input; Speaker (4 ohm) Output; Spare (2); Receiver Audio Input; VFO Input; VFO Output; IF Output; Driver Output; Ground Post; Power Plug; Accessory Socket (includes relay output); Antenna Input; Receiver Antenna Input; Common/Separate Antenna Switch. **Dimensions:** 5¾" H x 14¾" W x 13⅞" D. (Less knobs, feet and connectors). **Weight:** 20 lbs.

The SB-104 output board and final transistors are warranted for one full year.

HP-1144 SPECIFICATIONS — Output Voltage: 13.8 VDC regulated (Adjustable from approximately 11 to 16 VDC). **Maximum Output Current:** 20 amperes, intermittent. 8 amps continuous. **Transistor Integrated Circuit and Diode Complement:** 2N3643 transistor; 2N3055 transistor; 40411 pass transistor (2); MFC6030 regulator IC; 1N4002 silicon diode; MDA990-2 bridge rectifier. **Power Requirements:** 110 to 130 VAC @ 6A or 220 to 260 VAC @ 3A, 50/60 Hz maximum. **Dimensions:** 5½" H x 9¼" W x 10¼" D. **Regulation:** Less than 2% output voltage variation from no load to 20 amperes. **Ripple:** Less than 1% at 20 amperes. **Fuses:** 7-amp, 3AG, slow-blow primary. 20-amp, 3AG, output. **Net Weight:** 23 lbs.

SB-604 SPECIFICATIONS — Speaker Size: 5" x 7" oval. **Voice Coil Impedance:** 3.2 ohms. **Frequency Response:** 300 to 3000 Hz. **Magnet Weight:** 3.16 oz. **Cabinet:** Aluminum with gray wrinkle finish. **Dimensions:** 7⅛" H x 10⅛" W x 14" D.

SB-644 SPECIFICATIONS — Frequency Coverage: 5.0 — 5.5 MHz allowing 80, 40, 20, 15, 10 meter operation in the SB-104. **Frequency Stability:** Less than 100 Hz drift per hour after thirty minute warmup. **Modes of Operation:** Remote VFO; Main VFO; Receive Remote/Transmit Main; Receive Main/Transmit Remote; Crystal frequencies (2) (crystals not supplied). **Dial Backlash:** 100 cycles max. **Power Requirements:** 11V and 13.6V at 500 mA from the SB-104. **RF Output:** 0.34 to 0.4V RMS over 5 to 5.5 MHz into a 50 ohm load.

SB-634 SPECIFICATIONS — CLOCK — Display: Six full digits. **Time Base:** 24 hours. **Accuracy:** Determined by accuracy of power line frequency. **TIMER — Display:** Three full digits. **Time Interval:** 10 minutes with automatic reset. Manual reset at any portion of 10-minute period. **Accuracy:** Determined by accuracy of power line frequency. **Signal:** Visual only or both visual and aural; switch selected. **RF POWER/SWR METER — Frequency Range:** 1.8 to 30 MHz. **Wattmeter Accuracy:** ±10% of full-scale reading. **Power Handling Capability:** 2000 watts (maximum). **SWR Sensitivity:** Less than 10 watts. **Impedance:** 50 ohm nominal. **SWR Bridge:** Continuous to 2000 watts P.P. **Connectors:** UHF type SO-239. **PHONE PATCH — Circuit:** Telephone hybrid circuit. Allows voice control or manual operation. **TELEPHONE LINES — Input Impedance:** Approximately 600 ohm. **Null Depth:** At least 30 dB isolation between transmit and receive circuits. **Receiver Impedance:** Effective match from 3 to 16 ohm. **Transmitter Impedance:** 600 ohm or higher impedance output. **GENERAL — Meter:** 100μA movement. VU readings for phone patch monitoring. Null depth indication. RF power output, relative power, and SWR readings. **FRONT PANEL CONTROLS — Timer:** Off, Visual, Aural Visual. **Reset:** Pushbutton switch. **Patch Gain:** Transmitter, Receiver. **SWR:** Sensitivity. **Mode:** SWR, Forward and Reflected. 2000 W and 200 W. Phone Patch. **Rear Panel Controls — Clock:** Time hold, minutes set, seconds set. Null Adjust control; Null-Monitor switch; C adjust control; R adjust control. **Power Requirements:** 120/240 VAC, 50/60 Hz, 15 watts.

SB-614 SPECIFICATIONS — RF SAMPLING SECTION: Frequency Coverage: 80 through 6 meters (3.5 — 54 MHz). **RF Power Limits:** Exciter input (50 — 75 ohm) 10 to 300 watts; Antenna input (50 — 75 ohm) 10 to 1000 watts (up to 1500W PEP). **Insertion Loss:** Negligible. **VERTICAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 75 pf. **Sensitivity:** 60 mV rms/¼" vertical deflection. **Attenuator:** 2 position; x1, 2 volts rms max. input; x10, 20 volts rms max. input. **Frequency Response:** 10 Hz to 50 kHz ±3 db. **HORIZONTAL AMPLIFIER: Input Impedance:** 1 Megohm shunted by 50 pf. **Sensitivity:** 50 mV rms/¼" horizontal deflection. **Frequency Response:** 10 Hz to 3 MHz ±3 dB. **SWEEP GENERATION: Type:** Recurrent, automatic sync. **Frequency Range:** 10 Hz to 10 kHz in three ranges. **GENERAL: CRT:** 3RP1/A flat face, green, medium persistence phosphor. **Graticule:** .250 inch squares 6 x 8 (1.5 x 2.0 inches total viewing area). **Power Supplies:** All solid-state rectifiers. All amplifier supplies regulated. **Power Requirements:** 110-130 or 220-260 VAC, 50/60 Hz, 35 watts. **Front Panel Controls:** Intensity — Off-on; Mode — SSB, TRAP, CROSS; Focus; Vertical Gain; Vertical Position; Horizontal Gain; Horizontal Position; Sweep — variable; Range — 100 Hz, 1 kHz, 10 kHz. **Rear Panel Controls:** Astigmatism; Vertical attenuator —X1, X10. **Rear Panel Connectors:** Antenna: SO-239; Exciter: Phono; Vertical Input: Phono; Horizontal Input: Phono. **DIMENSIONS:** 7¼" H x 10¼" W x 15¼"D. **Net Weight:** 12 lbs.

SB-230 SPECIFICATIONS: Band Coverage: 80, 40, 20, 15 and 10 meter amateur bands. **Maximum Power Input:** 1200 W PEP SSB; 1000 W CW; 400 watts RTTY/SSTV. **Duty Cycle: SSB:** continuous voice modulation; **CW:** continuous (max. key-down time 30 seconds); **RTTY/SSTV:** 50% (max. transmit time 10 minutes at 400 watts). **Driving Power Required:** less than 100 W. **Third Order Distortion:** −30 dB or better. **Output Impedance:** 50 ohms at 2:1 SWR max. **Input Impedance:** 52 ohms at 1.5:1 SWR max. **Meter Switch:** Exciter only; Relative Power; Plate Current; Grid Current; High Voltage. **Front Panel:** Load; Tune; Band; Relative Power sensitivity; Power switch; Meter switch. **Rear Panel:** ALC output; Exciter relay; RF input; RF output; Ground lug; Fuse; Line cord. **Tube:** Type 8873. **Zero signal plate current:** 25 mA. **Power Requirements:** 120 VAC, 50/60 Hz, 14 A max. 240 VAC, 50/60 Hz, 7 A max. **Dimensions:** 14¾" W x 16" D x 7" H. **Net Weight:** 33½ lbs.

HEATH
Schlumberger

HEATH COMPANY
BENTON HARBOR,
MICHIGAN 49022

There are still tears and emotion, but much of the anxiety and assurances of safety have been replaced by information on duty changes, instructions to wives, requests for information on the kids, wifely requests for blue star saphire rings, etc.

Right now AFA7UGA is experiencing propagation problems because of the bottoming section of the eleven-year sunspot cycle, and Tom Moore has only two shifts of operators working. One starts at 4:30 a.m. and runs to 7:30 a.m.; then the other takes over and goes until the bottom falls out. Twenty-five to fifty completed patches a day is typical.

Typical, too, is the broken contact anywhere from 9:00 a.m. to noon, when the D-layers open up. "Four and a half KW's," says Tom then, "and all of it right out through the old chicken wire."

That's when he pulls the big switch and tells the sweet-voiced land-line operator, "We've been shot right out of the saddle. Better knock a couple of minutes of waiting time off that last call, and we'll buzz you tomorrow."

Then he secures the gear and the shack, ushers the nosey visitor out, and goes home to grab a bite before dashing off to work. Before he drives off, he hangs out of his car window and says, "You just can't imagine the dedication of our club members. Why, Bob Kraig W7OYC hasn't missed a Sunday in eight years. He works every Sunday from 4:30 a.m. until noon. That's the kind of participation that has made our station successful."

By the time the sunspot cycle has made MARS DX as good as an eyeball QSO again, there may be virtually no need for its Southeast Asian phone-patch services. But in case some other need arises, it's a good bet that Barry Goldwater and other shack owners will keep big books of thank you letters handy to remind them that they should keep the old bucket of bolts in good working order.

And the hams? You know they'll be ready.

...K7NZA

For FREQ. STABILITY

Depend on JAN Crystals. Our large stock of quartz crystal materials and components assures Fast Delivery from us.

CRYSTAL SPECIALS

2-METER FM for most Transceivers 144-148 MHz — .0025 Tol.	ea. $3.75
Frequency Standards	
100 KHz (HC 13/U)	4.50
1000 KHz (HC 6/U)	4.50
Almost all CB Sets, Tr. or Rec. (CB Synthesizer Crystal on request)	2.50
Any Amateur Band in FT-243	1.50
(80-meter, $3.00 — 160-meter not avail.)	4/$5.00

For 1st class mail, add 20c per crystal. For Airmail, add 25c. Send check or money order. No dealers, please.

JAN CRYSTALS

Division of Bob Whan
& Son Electronics, Inc
2400 Crystal Drive
Ft. Myers Florida
33901
All Phones
(813) 936-2397

Send 10c for new catalog with 12 oscillator circuits and lists of frequencies in stock

New! **NOVICE CLASS STUDY GUIDE**

Much more than a Q&A Manual. With this new book you LEARN the THEORY. So simply explained that anyone can understand it the first time through. Never has there been such a simple theory course. Be ready for that 1974 FCC Exam with this 1974 book.

Other study manuals ask you to memorize questions and answers – this one lets you learn the theory so • • •

you'll know the **ANSWERS**

1974 EDITION . . . $4.95

73 Magazine – Peterborough NH – 03458

GRR GRRREEN

SPELL MY NAME RIGHT

There is an old addage that any publicity is good publicity – say anything you want to about me, but spell my name right. In this vein I would like to express restrained appreciation for the PR job being done in my behalf by ARRL officials. It *is* nice to be recognized.

I am sure that some of the people who have devoted a good deal of the last ten years hating my guts for opposing the "incentive licensing" restructuring of amateur radio will be as astounded as I to hear that it was I who was responsible for this debacle which the FCC is now getting ready to try and rectify. My opposition to that ARRL petition for rule making (1963) was on the philosophical grounds that it is psychologically better to get desired results with a carrot than with a stick – the result in this case being to encourage amateurs to go for higher classes of license. Taking away bands to force amateurs to increase their grade of license would, I felt, create resentment and frustration.

The League worked hard and long to get their proposals accepted and they succeeded. Yet today I have a tape of my good buddy Lew McCoy telling a club that I was responsible for incentive licensing. While on the one hand I suppose that I should be flattered that the single most important change in the amateur rules, in recent years, was due to me, it is difficult to pretend anything but resentment over the whole concept of using punishment instead of rewards to achieve ends. . .which is what incentive licensing comes down to.

Surely I must be either lying or exaggerating – right? In case you might find a copy of this tape of interest – Lew talks about the current FCC plan to restructure amateur radio – tells how badly the recent FCC hearing went – and has some interesting things to say about Prose Walker – this is all available on a 90 minute tape for $5 from 73, Peterborough NH 03458. Ask for the Real McCoy.

RADAR ZAPPER?

A chap stopped by the 73 offices the other day – reads 73 – goes by the name of Bad Back on channel 10 he said. He was awfully concerned about the new two-way radar which allows police in unmarked cars to get copy on Bad Back's speed even when they're going in opposite direction. There must be something that can be done about an invasion of privacy like that!

Another channel 10 denizen who goes by the name of Radio Doctor (he fixes FM sets) stopped by and explained that what Bad Back needs is a simple 10.5GHz oscillator modulated at 3400Hz. This would add 100 mph to the radar reading, which would either result in one whale of a speeding ticket or a very confused cop.

While we certainly don't want to help people break the law, even by speeding, the idea that it would be nice to have a little old 10.5GHz oscillator circuit around for testing out those radar units stuck in mind. I'm sure that there are a whole lot of readers who at one time or another would like to be able to help a state trooper test out one of those damned radar units. So, how about it. . .any Edison types out there who can coax enough 10.5GHz rf out of something we can all afford to cut the mustard? You know, a thing like that might sell like crazy at truck stops if some entrepreneur got busy making them.

MAKING YOUR HOBBY PAY

I've been looking back over the last year or so of 73 and, while we've had some exciting articles, I just don't feel that overall we've had as much really good stuff as we used to. We need a lot more articles and we are going to pack the magazine with them.

If you've built something that your friends are enthusiastic about, whether it be a receiver, QRP rig, FM rig, repeater, sideband rig, amplifier, keyer, test equipment, an antenna, logic or digital circuits, preamplifier; if it's your own design then you should write it up (double space typed), sketch the circuit, and have a couple of pictures taken (or send in the unit so I can take the pictures).

There are several benefits. First of all it is nice to be a published author. Your friends will be impressed at the club -- and when you get on the air you'll be surprised at how many fellows know you. It doesn't hurt with your own family and non-ham friends either. The cash we pay for articles may not put you into a higher income bracket, but it will help buy a new rig or some parts. We do pay well compared to some of the other ham magazines. . .very well. Several of our writers have made thousands of dollars.

It doesn't hurt when you're applying for a job to have a list of your published articles on your resume.

While I am more interested in construction projects, large and small, than anything else, we still need a lot of articles on every aspect of our hobby: DXing, traffic handling, MARS, Races, certificate hunting, contests, moonbouncing, satellite work, CW, VHF DXing, VHF sideband, antennas of all sorts, 160m, Novice problems and solutions, service net info, intelligent discussion of FCC dockets and proposals, and even humor.

One warning – it might be prudent not to say too much around home about how much we pay for articles. One author let his wife know how much he was getting and from then on she made him write ten pages every night before she would let him go to bed with her. He was one of our most prolific writers.

. . .WAYNE

DANGER
5000 OHMS

SOME PEOPLE TALK POWER - WE DELIVER IT.

VHF, CLASS C POWER AMPLIFIERS

- 2 METERS
- CW AND FM OPERATION
- FULL ONE YEAR WARRANTY
- SELECTION OF POWER RATINGS

MODEL P15A1 — Nominally 0.5 - 2.5 W RF input for 5 - 25 W output. 13.4 V at 2 amps. $59 FOB Factory

MODEL P50A10 — Nominally 1.5 - 20 W RF input for 8 - 65 W output. 13.4 V at 6 amps. $98 FOB Factory

MODEL P100A25 — Nominally 15 - 30 W RF input for 75 - 110 W output. Remote control available. 13.4 V at 14 amps. $155 FOB Factory.

MODEL P100A10 — Nominally 1.5 - 18 W RF input for 60 - 120 W output. Remote control available. 13.4 V at 14 amps. $198 FOB Factory.

These quality power amplifiers are designed by M-TECH Engineering and manufactured under rigid quality control by American Basic Corp., Electronics Division. Dealers please inquire for details.

ELECTRONICS DIVISION
American Basic Corporation

542 NORTH FREDERICK AVE.
GAITHERSBURG, MD. 20760
(301) 948-6701

FREE

CLUBS•CLUBS•CLUBS

great trade offer

We will swap you a year's FREE subscription to 73 HOTLINE for a year's subscription to your club's bulletin. How can you loose? Just complete the form below and return. . .

Name ______________________ Call ____________

Address ______________________________

City ________________ State ________ Zip ____________

Voxpoop

Readers have been asking for articles and commenting on 73 – here are some of these recent comments: Let's see some RTTY info. How about a surplus column? You devote far too much space to 2m stuff! – WA6SOJ. *(That's a good idea about the surplus column, anyone interested in working on that? Send in an outline of what you would cover and a sample column. . .wayne)* Like the article on the 10 minute timer – WA1PAL. Need more product reviews. Encourage owners of new equipment to comment. Restrict the articles to top flight equipment only. Who cares if poor items are poor? – W9BNQ. *(Excellent! Readers should remember that 73 pays for articles, so if you get something new and have an interesting report on it, pass it along. . .wayne)* It was nice to see the 390/392 surplus article, but these are out of my price range so I would like to see articles on cheaper surplus – especially 160m and FM gear – WA6SLN. *(Right, how about it readers?. . .wayne)* Newspages are great and the IRS notes interesting to say the least. Would like to see more specialized columns such as RTTY, fast scan TV, and VHF work. The brevity of the DX and contest columns are appreciated, but also contain info enough for those who are interested in these fields. Keep up the good work – W5SSN. Keep up the IRS info – WB6AYJ. How about an article on a homebrew 2m FM repeater? Solid state or using the VHF Engineering modules? – WA3WID. *(In the works, watch for it. . .wayne)* Possibly more antenna articles, including 2m FM – WA7WOC. Enjoyed all your articles, particularly K1CLL! Maybe you could keep both solid state columns? – WB2PAP. Circuits is great and liked Scott's solid state column. Less repeaters and don't forget the CW guys, particularly QRP. More on ICs and simple transistor circuits – K6AE. *(Bill has said it, so let's see more QRP, more CW articles, more ICs, and build up those simple gadgets for us. . .wayne)* I'm tired of reading about your troubles with the IRS – WA7SFL. The magazine needs more theory articles such as in a continuing series – WN7VUC. *(Any volunteers to write same?. . .wayne)* Don't forget the Novice projects, we need them! – WN2TQM. *(Let's have a whole lot of info for Novices – simple projects to build – rigs – QRP – operating ideas, the lot. . .wayne)* Would like to see more of K1CLL; more VHF and UHF construction articles – K5HTE. *(We have a lot more in the works Doyle, and plead with readers who are playing with this stuff to write as CLL is retiring!. . .wayne)* I like the editorials and newspages the best. It's impossible to print too much on 2 meter FM. Like articles on antenna design and construction – WB0FZL General discussion of propagation conditions and the sunspot cycle and when it will get better – WN3VZN. *(Alas, better is still a long way off. It's best to cope with it as it is and enjoy – there's lots of good stuff to work. . .wayne)* Please put in more UHF construction articles – WN0MBY. Boy, do you troops fill a gap in the ham hobby! Just keep up the good work – more easy to build construction projects – how about the care and feeding of LEDs? Any tube projects in mind? Just curious – K7ATU. *(Yep, we have some coming along for us old timers and Novices too. . .wayne)* The Circuits column is great. How about an antenna column?. . .that's all that is keeping me subscribing to CQ – WB0ICG. *(Lordy! I never realized how badly 73 needed an antenna column before. Any volunteers with an outline and sample column?. . . wayne)* You got a good ham radio magazine, thanks – WN8RDN. *(Thanks Mike. . .wayne)* VHF 2m FM construction, starting simple and working up to the complex – W7DOU. Both solid state columns were good – WB0NAG. I liked Scott's solid state column best – WA2ADZ. We need more news about what the DOC/FCC is doing about clamping down on CB and what we hams can do about these bootleggers – VE2BAQ. *(The Canadian proposal to legalize hobby and skip CB operation could be the answer – and it could mark the end of amateur radio too. . . wayne)* I think 73 is well balanced so keep up the good and interesting work – WA8SHT.

RECIPROCAL LICENSES IN THE UNITED KINGDOM

Overseas members are reminded that there are several different types of license available to them allowing them to operate amateur radio stations in the U.K. provided a reciprocal licensing agreement exists between their country and the U.K.

The simplest form is an authorization for a visiting amateur to operate the station of a licensed U.K. amateur. In this case no call sign is issued. For example, should F8TH operate from G3BID under this arrangement he would use G3BID's call and sign the log as operator just as another G operating from G3BID would have to do. Such permission is granted for seven days maximum.

The other category is when a G5-plus-three call is granted and it is here where some confusion seems to have arisen. There are two types of such license. Amateur (Sound) license C and Amateur (Sound Mobile) License C are valid for one year and are only issued to persons coming here for more than three months (NB this may be six months now). It is intended for those coming to work or live and such applicants must produce an Alien's Registration Certificate before a C License will be granted.

The second of this type of license is probably the more frequently issued and is the D License which is now valid for six months. This is the one to apply for when you are coming here on a vacation and, like the C version, is available for fixed or mobile operation.

An important point to remember is that you may apply just for the mobile license if you are not going to operate a fixed station. By contrast U.K. amateurs cannot be granted a mobile license unless they also hold a fixed station license.

Full information on reciprocal licensing can be obtained from the Society's Information Service. The address is: BCM/ARMS, London WC1V 6XX

Please do NOT send queries on reciprocal licensing to any other address as it will only delay matters. When you get the information, please read it carefully and make sure you apply for the proper type of license.

Mobile News

THE LONG WAVE CLUB OF AMERICA

Michael Kane's (WA1PJG) letter about ULF listening prompted me to write. There is indeed a club devoted to dxing the frequencies below 550kHz known as The Long Wave Club of America which started this January. (Present membership is about 75.)

We publish an 8-page mimeo bulletin called the Lowdown which lists member's loggings and carries technical articles from time to time. Sample copies are available for SASE. Of particular interest is the license free band (160-190kHz) which we are trying to organize – I am looking for an editor to write a column on activities in this area. Dues are free and to join just send a letter that you wish to receive the Lowdown. I am, however, asking all joiners to send me a year's supply of self-addressed *legal size* envelopes to cut down on publishing time. Also a log of 2500 beacons in the western hemisphere is available in limited quantities (like about 80) from the club for $2.00 postpaid. Write: John Clements, President, Long Wave Club of America, 11425 Albers Street #5, North Hollywood CA 91601.

airwaves electronic

IN STOCK
Bearcat Scanning Monitors,
Crystals and Modules

MIDWEST HEADQUARTERS
for
MIDLAND and SBE
2 meter FM

Call for our Special prices
(312) 355–3524
Or write for full details . . .

JON – WB9NIH
DON – WB9IFI

805 east ogden ave.
naperville ill. 60540

OUTPUT
SELECTIVITY
OFF
Q-BOX
AUTEK RESEARCH

30 Hz Selectivity!

" . . . a must for anyone using an inexpensive receiver or a sideband transceiver on our crowded CW bands."

(73 Magazine test report)

Our Q-BOX audio filter features: Bandwidth CONTINUOUSLY VARIABLE from 30 Hz (almost 100x sharper than most xcvrs!) to 2 kHz. Active filter (no coils). No insertion loss. Not a breadboard. Ready to plug into ANY rcvr/xcvr. Drives phones or ext. spkr. amp. Full instructions. In use worldwide. Plug one into your receiver today! . . . Only $17.95 + $1 shipping in U.S. (Add Sales Tax in Cal.) 10 day moneyback guarantee. SEND FOR FREE LITERATURE AND TEST REPORTS.

AUTEK research
Box 5390L, Santa Monica California 90405

R&L T-T PAD
(RF SHIELDED)

A Miniature Touch-Tone pad containing a Hybrid Silicon IC using the Tantalum thin-film process.

THE ENTIRE PAD IS ENCLOSED IN A CUSTOM MILLED ANODIZED ALUMINUM CASE ONLY
3"x2¼"x½"

$49.95

Plus $1.00 for postage and handling. Send check or money order to address below.
(CA residents add 6% tax)

SIMPLE 3 LEAD INSTALLATION CAN BE USED WITH ANY HAND-HELD, MOBILE OR BASE RADIO.

R & L Electronics
ELECTRONIC EQUIPMENT AND COMPONENTS
Send to: 12474 West Washington Boulevard
Los Angeles, California 90066 • (213) 398-5377

Solid State from page 17.

high on the appropriate digit select pin. Both BCD and digit select outputs have three state controls providing an "open circuit" when these controls are high and allowing time multiplexing. Several MC 14534CL's can be cascaded to provide higher count sequences. This counter can be used in many real time counting applications such as event, frequency and control counters. When used with faster logic families, it could become a significant part of a VHF frequency counter.

Both of these CMOS ICs are intended for 5 to 15 VDC operation. Power consumption is from 2 to 37 milliwatts. Both are available from your Motorola distributor at $25.26 for the MC 14534CL and $8.34 for the MC 14536CP in single quantities.

An observant reader, Max Hauser of W6-land, reminded me that in my July column (written in Jan.), I overlooked two quad op-amps that are now available. These are the National LM324 and Raytheon RC4136 which are claimed to meet or exceed all specifications for the single 741 op-amp. You can obtain these ICs from several 73 advertisers for approximately $2.00.

Finally, why don't you send that QSL listing your ideas right now while you're thinking of it. 73 for now!

MORE IRS MAIL

I've been reading with initial shock and increasing horror about the tyrannical tactics of the IRS, both in 73 Magazine and in the newspapers (I remember seeing that story break last summer concerning the several IRS agents all coming up with different ways of figuring identical tax returns – it seemed funny then, but it isn't funny anymore). I was intrigued by your reporting the element of the "tax revolt" that crosses out the perjury statements on its several returns, and decided to try it. Much to my surprise, it works!! I mailed my form 1040A (short form) on 25 January and received my refund March 4. I also crossed out the perjury statement on my sister's return, which I prepared; her refund came in the mail with mine. Our refunds totaled over $500.00. So, chalk one (or two) up to the "tax revolt." I hope we can, through modification (read "sweeping revision") of the federal tax laws, eliminate its necessity for existence, but until then, it *is* necessary for it to exist.

To change the subject (but not a lot), thank you for being controversial in 73. I am a life member of ARRL and a lifetime subscriber to 73, and I find both QST and 73 necessary to have. I think they complement each other quite well – the conservatism of QST and the liberal (if not sometimes radical) stands taken by 73. Your editorial policy re technical articles has been vindicated many times over, and I prefer your policy of finishing one article before starting another (thus eliminating the "see page x" nonsense found in almost any other given magazine of over 8 pages).

You got me interested in Mensa through editorial mention of it some 3 or 4 years ago. I've since joined and enjoy being an M quite a bit (whenever my ego is feeling bruised I get out my membership card and look at it for a while). Haven't seen anything about it lately in 73, though.

Enjoyed the article about calculators in December issue. Got a Texas Instruments SR-11 and that is one real nice piece of stuff for only a hundred and ten dollars – it's kinda like a "poor man's HP-35!"

Please don't publish my real name if you decide to print this letter in the magazine. I've got enough problems trying to graduate from college and work fulltime without having the IRS on my ass, as I'm sure they would be if my name and call were published.

Keep on keepin' on, Wayne!

Name Withheld

Caveat Emptor?

PRICE – $2 per 25 words for non-commercial ads; $10 per 25 words for business ventures. No display ads or agency discount. Include your check with order. Deadline for ads is the 1st of the month two months prior to publication. For example: January 1st is the deadline for the March issue which will be mailed on the 10th of February.
Type copy. Phrase and punctuate exactly as you wish it to appear. No all-capital ads.
We will be the judge of suitability of ads. Our responsibility for errors extends only to printing a correct ad in a later issue.
For $1 extra we can maintain a reply box for you.
We cannot check into each advertiser, so Caveat Emptor . . .

FOR SALE TR4-$375, AC4-$75, DC4-$1.00, SB102-$350, Linear Systems 400-12-$100, HP23-$40. Consider station deal. Walt Hagen, WA2ALV, 19 Aviation Road, Glens Falls, New York, 12801. Phone: H 518-792-5162. B 518-793-4491 X60.

FREE: 12 extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Atlas, Kenwood, Standard, Clegg, Swan, Genave, Hallicrafters, Tempo, Ten-Tec, Venus, Hy-Gain, CushCraft, Mosley and Hustler, write to Hoosier Electronics, your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

PERSONAL ATTENTION plus the best cash deal anywhere is what you receive at QUEEN CITY ELECTRONICS in the heart of the Midwest. Queen City carries all major brands including Drake, Tempo, Kenwood, Yaesu, Swan, Regency, Clegg, Standard, ICOM, Genave . . . write or phone us for your equipment needs. Queen City Electronics, Inc., 7404 Hamilton Avenue, Cincinnati, OH 45231 (513) 931-1577.

FOR SALE: Thriving 2-way Business in medium size Midwest market. $40,000.00 annual Gross. For further information write c/o Box J, 73.

TWO PLASTIC HOLDERS frame and display 40 QSL's for $1.00, or 7 holders enhance 140 cards for $3.00 – from your dealer, or prepaid direct: TEPABCO, Box 198M, Gallatin TN 37066.

WANTED: Top prices waveguide, coaxial components, all makes. Late HP, Tekronix, GR, Military Test Equipment. LECTRONIC RESEARCH, 1423 Ferry Avenue, Camden NJ 08104.

FOR SALE: Gonset IV – 6 meters. Like factory new with manual and power cords. postpaid $125.00. Ameco – 621 VFO with manual. postpaid $45.00. Regency HRZB (6 sets crystals) all standard. All accessories plus, ant specialists asps-177 5/8 3dB gain whip, plus Regency P-109 regulated power supply and manual. $275.00 or trade for a Drake R4B. Call or write Jim W1VYB (617) 922-3850.

VIDEO TAPE RECORDERS Ampex 1" VR7500 (2), $250.00 each; VPR4950 (2) $150.00 each. with tape, and tech. info. Buyer p/u. Need food 2m synth. rig (Clegg or equiv). G3NDY/W2, John Anthony, 30 Quaker Bridge Road, Croton NY 10520. 914 271-3210.

JIG SAW PUZZLES wanted. If you have any old wooden jig saw puzzles in your attic – or run across them at an auction (they go for 25¢ usually), please keep in mind that Wayne Green collects them and might even pay a buck a peice for them. c/o 73 Magazine, Peterborough NH 03458. Wood, not cardboard – and complete.

STANDARD FM Equipment – special huge discounts, 2m FM; 10 watt base/mobie SR-C 826MA crystal for 4 channels $335 ppd. 2 watt handie talkie, SR-C 146A, crystals for 2 channels $240.00. Order now, write for catalog. Larger discounts on units of 3 or more. Bercom Electronics, P.O. Box 237, Bergenfield NJ 07621.

WANTED any condition: HAL RVD-1002 visual display unit, ST-6 terminal unit, HP-608 signal generator. State lowest price and condition. K7VOY, 1414 E. Verlea Drive, Tempe AZ 85282.

2 METER FM MOBILE "cartop" Antenna. Unique, secure, instant mount. No magnets; no drilling holes. XYL will approve. Outperforms trunk lid mounted antennas. Tuneable 1:1 SWR. Money-back guarantee. $16.95 plus $1.00 shipping. (Conn. residents add Sales Tax.) MARSH DEVICES, P.O. Box 154, Old Greenwich CT 06870. Literature available.

MOTOROLA PORTABLES Expert repairs, reasonable prices, fast turnaround time. More details and flat rate catalog FREE. Ideal services, 6663 Industrial Loop, Greendale WI 53129.

RCA SENIOR VOLTOHMYST – professional grade VTVM, new, never used. $50. WA1TEJ, 100 Granite St., Londonderry NH 03053.

PERSONAL ATTENTION plus the best cash deal anywhere is what you receive at QUEEN CITY ELECTRONICS in the heart of the Midwest. Queen City carries all major brands including Drake, Tempo, Kenwood, Yaesu, Swan, Regency, Clegg, Standard, Icom, Genave. . .write or phone us for your equipment needs. Queen City Electronics, Inc., 7404 Hamilton Avenue, Cincinnati OH 45231 (513) 931-1577.

FREE: 12 extra crystals of your choice with the purchase of a new Regency HR-2B at $229. Send cashier's check or money order for same-day shipment. For equally good deals on Collins, Drake, Kenwood, Standard, Clegg, Swan, ICOM, Genave, Hallicrafters, Tempo, Midland, Ten-Tec, Venus Hy-Gain, CushCraft, Mosley, and Hustler, write to Hoosier Electronics your ham headquarters in the heart of the Midwest. Become one of our many happy and satisfied customers. Write or call today for our low quote and try our individual, personal service. Hoosier Electronics, R.R. 25, Box 403, Terre Haute IN 47802. (812) 894-2397.

DESIGN ENGINEERS. Our expanding Atlanta based electronics company has several opportunities for BSEEs or MSEEs Design Engineers to join our group dedicated to the design and development of satellite communications equipment. We are seeking candidates for these positions who are hardware oriented engineers with background in some of the following areas: Solid State Microwave low-noise and power amplifiers; Frequency converters; Analog & Digital modems; IF Circuitry; Base band processing circuitry; Frequency sources; MIC Techniques. To explore these excellent career opportunities, please call collect to: Bob Placek or Jim Wallace 404-938-2930. Or send resume in confidence to: Personnel Manager, Scientific-Atlanta, Inc., P.O. Box 13654, Atlanta, GA 30324. An equal opportunity employer.

VERY INTERESTING! Next 5 issues $1. "The Ham Trader," Sycamore Il 60178. (Ask about our "HAM EQUIPMENT BUYERS GUIDE" covering Receivers, transmitters, transceivers, amplifiers 1945–74. Indispensable!)

SELL: ROBOT SSTV Models 80 Camera and 70 Monitor. Original cartons and instruction books. Excellent condition. $500.00. Gordon Buckner W0VZK, Box 721, Marshall MO 65340.

REGULATED POWER SUPPLIES 13.8 volt 3% regulation. 3.5 amp – 34.95 7 amp 59.95. Also 1, 14, 25 amp. Meters available. Enterprise Electronics, Box 61, Monroe OH 45050.

Continued next page.

WANTED: 40 or 50 foot tower. HW-202 xcvr. SELL: DX-60 B xmtr and Johnson TR-switch. George Kirvan WA1RVB, 19 Huckins Avenue, Quincy MA 02171.

MOBILE IGNITION shielding gives more range, no noise. Everything from economical suppression kits to custom shielding, literature Estes Engineering, 543-A West 184 Street, Gardena CA 90248.

REWARD! Ten dollars reward for return of 73 Magazine flag lost at Dayton.

TV-3B/U NAVY portable tube tester, good working condition. $25. WA1TEJ, 100 Granite St., Londonderry NH 03053.

CALL LETTER LICENSE PLATES – still being collected by 73 Magazine for possible cover use. Please send in an old call letter plate – most treasured are out-of-district plates such as W2NSD/NH, etc. Got any real oldies? 73 Magazine, Peterborough NH 03458.

TR22C 3 mos. old, absolute mint, various NYC xtals, plus Tempo 502B amplifier (1 watt in/45 out) $250. John Schultz, 212 867-5200, ext. 329.

NEW SURPLUS – Free catalog – Laser Diode, 6W, 25A, GaAs: $10.75; 8038 VCO: $5.95; INTEL 8008: $59.45 1101 RAM: $2.25; 1103 RAM: $4.50 NIXIE B585351, .5": $2.50; DL707: $2.50 LIQ. Xtal, 3½ digit, .4x.22" char: $9.75 2513, 2516: char. Gen. Roms: $12.75 Electronic Discount Sales, 138 N. 81st St., Mesa AZ 85207.

TECH MANUALS for govt. surplus gear – $6.50 each: R-390/URR, R-220/URR, URM-25D, CV-591A/URR, CV-278/GR, TRM-1, TS-382D/U, TS-497B/URR, TT-63A/FGC, URM-32. W3IHD, 7218 Roanne Drive, Washington DC 20021.

TOROIDS 88 mh, 44 mh, unpotted, $5 dozen; AN/URR-13 receivers, 200-400MHz, tuneable, $35; 24 volt p/s $30. Telecom, Box 4117, Alexandria VA 22303.

CANADIANS We stock a broad line of electronic parts, including solid-state – send for free flyer, DARTEK ELECTRONICS, Dept. 7, Box 2460, Dartmouth, Nova Scotia.

YOUR SWAP-N-SELL ads run free in TRADIO, a public service publication of Wichita Amateur Radio Society Box 4391 Wichita Falls TX 76308.

DUAL MODE Hal DKB-2010 keyboard with 128 key buffer. Factory assembled, brand new – won at Dayton 1974. $510. Richard Mawhorter, 10584 Latina Ct., Cincinnati OH 45218.

INSTRUCTION MANUALS Thousands available for test equipment, military electronics. Send $1.00 (refundable first order) for listing. Service of Tucker Electronics, Box 1050, Garland TX 75040.

AN/FRR-23 (AN/SRR-13) general coverage modular receiver with book, excellent condition. $100. WA1TEJ, 100 Granite Street, Londonderry NH 03053.

MORE LETTERS

MORE WANTS

I would like to see more articles like Circuits, Circuits, Circuits.

Since Moon Bounce is becoming more and more popular perhaps an article on it e.g., What One Needs to Do. Maybe even a design of a receiver and transmitter and an amplifier and a good antenna system one could use.

How about an article on long hop 2 meter DX, on FM, AM, CW or SSB.

Your September 73 issue showed a 2 meter converter – how about a PC board layout and maybe one for a 10W transmitter converter.

Just a few things perhaps you could use. Keep grinding out the good stuff.

Gary VE1AHM

OK, Gary. Those ideas may get some readers writing, wayne.

LOST

Here are the details on our new repeater. Took only 3 1/2 months for approval. However, some local Novice and Tech applicants have been waiting for 5 or 6 months for their license. After 2 months of writing the FCC, one licensee finally got a reply from the Commission saying his application was "lost" and to take all the code and written tests all over again! I remember when it took only 6 weeks from Novice code test to license. Those were the good old days!

Tom Norman
Laurinburg NC

GOOD WORK

Keep up the good work with 73 Magazine. I still consider 73 the only ham publication worth having in my shack. I especially like the "circuits" column, and its many useful ideas.

I never before thought the IRS was so bad but after reading about some of the readers experiences I now realize just how "kind" the IRS is. Your comments are thought provoking.

Again I say, keep up the good work.

Stephen Brockman WB8GVP
Hamilton OH

CAVEAT EMPTOR: KITS

I have a few words of caution for purchasers of some of the very attractive (on paper) kits available. Do not expect the instructions and schematics to be up to Heath quality. Check all plated-through holes of two surface printed circuit boards for continuity. Otherwise an open one may be found later under a component difficult to remove. Make a sketch of all leads on the top of the board that are under sockets. The information may be needed later in troubleshooting.

If the sockets are cheapies, they may have to be replaced or each IC custom fitted to its socket by bending pins. Both procedures are time consuming. Use a tool for inserting and removing ICs. Stranded wire with fused tining is convenient to strip and handle but cannot be flexed much without breaking.

If the instrument consists of several functions, construct and test each before assembling if possible. For example, construct and test a frequency meter before proceeding; it has many parts and all have to function correctly to obtain a proper count. Keep in mind that 2W resistors dissipating 2.5W make good heaters.

Voltage controlled oscillators can be very unstable and show excessive drift when the supply is regulated by hot zeners. Fluctuation in zener voltage will cause fluctuation in frequencies. In one example, the oscillator drifted from 138 kHz at turn on to 214 kHz one hour later.

A Raytheon RC-9194DP dual voltage regulator reduced drift to 10 kHz and ended fluctuations. Heat from the zener regulating the supply voltage for the digital circuits was eliminated by using a 7805 mounted on the aluminum housing. These changes are much easier to make at the beginning of assembly than later.

Do not expect all of the wave forms from IC function generators to be identical with the pretty pictures in the advertisements (magazine articles). Expect assorted glitches, interactions and unwanted modulations not described in the ads.

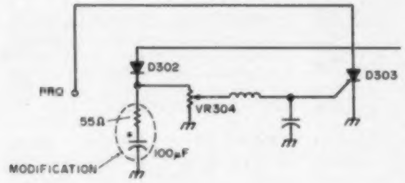
These are just a few of the problems to be expected from the complex kits now available.

Frederick Kavanagh
Indianapolis IN

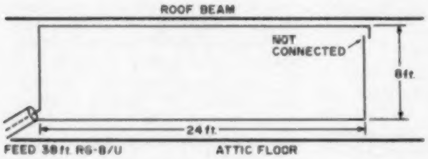
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the reference books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

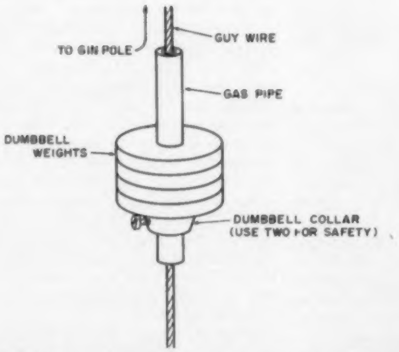
Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.


D302
D303
PRO
VR304
55Ω
100μF
MODIFICATION

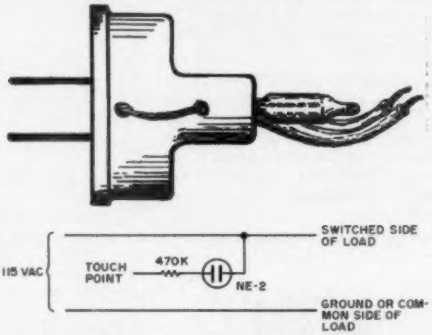
SB-144 mod to key an amplifier – added 55 ohm resistor and capacitor delay the SWR protection circuit for a fraction of a second permitting relay in amplifier to switch over. Thanks WB9IMM.


ROOF BEAM
NOT CONNECTED
8ft.
24 ft.
FEED 38ft. RG-8/U
ATTIC FLOOR

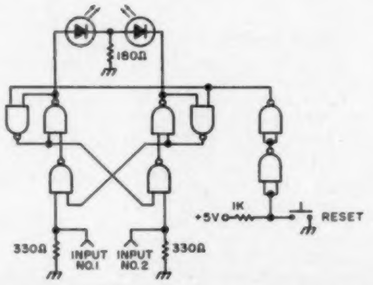
W8KOI attic antenna for 40 and 15m. Uses RG8/U and no balun. Use #18 wire and staple gun for installation. No bad antenna whery an outdoor antenna is a problem.


TO GIN POLE
GUY WIRE
GAS PIPE
DUMBBELL WEIGHTS
DUMBBELL COLLAR (USE TWO FOR SAFETY)

WA0KKC aid for pulling tower sections up a gin pole uses hollow gas pipe and dumb bell weights for counterbalance. Clever!


115 VAC
TOUCH POINT
470K
NE-2
SWITCHED SIDE OF LOAD
GROUND OR COMMON SIDE OF LOAD

Hot line side finder – uses body capacity to light neon bulb – glows only when bulb connected to hot side of line – resistor value not critical. Thanks B. Sutphin of St. Petersburg FL. Could save your life.


180Ω
+5V
1K
RESET
330Ω
INPUT NO.1
INPUT NO.2
330Ω

Which input is first? This circuit will tell. Makes a good game – with two people trying to push a button first, etc. Two 7400's may be used. Thanks WA7SBH, who gets a free book of his choice for submitting this circuit.

CORRECTION

73, June 74, p. 77

FSK Demodulator from July 19, 73 Electronics: You left out the Bridged Tee feedback loops on both 741's. I sent you the clipping from my copy, but I am sure they were on the original. Hi-Z in, so audio feed is no problem except for too much input and distortion.

Fritz K4ETZ

CASSETTE RECORDERS

SONY TC-152SD

Features: Automatic shut-off – line in/line out – mike attenuator – spill-proof tape transport – separate monitor/playback vol and tone controls – tape counter – stereo headphone jack – pause control with lock – two VU meters – nicad recharger peak limiter – Dolby noise reduction circuit – CrO_2/normal tape bias selector – 117 vac/ 12v dc operation – will work from car battery or optional nicad pack – built in monoural amplifier and speaker for monitoring – ferrite heads – slide record controls – just about the last word in tape decks, and portable too! Most cassette deck experts agree that this is the finest unit available today – and it is portable to boot.

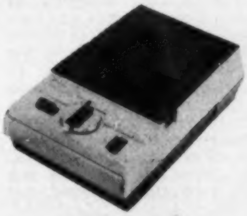
Sony TC-152SD complete $299.00 (shipping included).

$50 worth of cassettes FREE with 152 if ordered before October 15, 1974.

Panasonic RS-261US

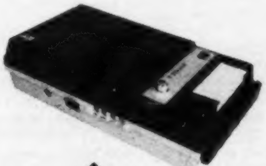
Features: stereo deck – pause control – CrO_2 bias or normal – automatic stop at end of tape – two VU meters – counter – headphone jack mike input – line in and out. Great medium price cassette deck quite adequate for top notch SSTV work – put your records on tape.

FREE with RS-261US – $20 worth of blank tapes. . .$99.00



ECONOMY PORTABLE

Features: Rotary control for ease of use with one hand (like in the car) – peak indicator – automatic level circuit for optimum recording level at all times – 117 vac – built in batteries – remote stop-start mike input – line input – earphone/line output – fine unit for voice or Morse code study – adequate for lo-fi music – excellent bargain at the price. $23.95



BATTERY PORTABLE

Features: keyboard control – locking fast forward and rewind keys so you don't have to stand and hold them – peak modulation indicator – 120 vac – self contained batteries - external 6v supply – 220 vac also mike input – line input – earphone/line output – remote start/stop – automatic recording level circuit – very easy unit to use – versatile – adequate for SSTV – excellent for code tapes and not too hi-fi music. $32.95

BLANK CASSETTES

Low noise tape cassettes – excellent quality

C-60 60 minutes. . . 99¢ (reg $1.29)
C-90 90 minutes. . .$1 49 (reg $1.79)
C-90 Extra Hi-fi. . .$2.25 (reg $2.99)

CAR CASSETTE PLAYER – 12vdc – stereo – with two stereo speakers – volume and tone controls, balance control – fast forward for tape and reject button. Now carry hi-fi with you in the car – slow scan TV – touchtone tapes – your favorite records on cassettes.

Car Cassette Player. . .Special. . .$49.95 plus UPS collect charges.

ORDER TODAY FROM

Cassette HQ – Box 431 – Jaffrey NH 03452

LETTERS *from page 15.*

FCC BRAVOS

Just like to send a note about an experience dealing with the FCC. I was employed this summer as one of two counselors in a summer camp instructing in ham radio. As part of the instruction, those interested in obtaining their licenses were drilled on code and theory and then administered their Novice tests while at camp. We had one camper pass his code test about halfway through the season and within two weeks had received his written. Somehow during the period he had completely lost interest and declined to take the written. Meanwhile another young camper had passed his code test and since time was running out, we feared the written portion of the test would not arrive in time. Being only 20 or so miles from Gettysburg, I made the trip there one afternoon. After passing the building 4 times, unknowingly, I got directions and entered the small recessed office. Upon entering I was ushered to the main office area from the lobby and proceeded to explain my problem to the woman at the nearest desk. She escorted me to another clerk to whom she explained the problem, and they both put aside what they were working on and began to pull out other files. In a matter of minutes the necessary paperwork had been completed and a Novice test package completed, addressed and sealed. When they handed me the test, it was with a smile and a wish of good luck for the applicant.

I was amazed that with all the work they have, they could make time to handle a problem like mine and be very friendly about it. Take my word for it when I say they have some wonderful people down there.

Chuck Davidson WA3LXB

PHONE PHREAKS VS MA BELL PART II

If you're like me, the original article on the "Phone Phreaks VS Ma Bell" left me on edge like an Alfred Hitchcock movie. Being an inquisitive individual, I began my search at the local library for the October 1971 issue of Esquire magazine. Mr. Rosenbaum's article was also a Hitchcock special, as he rather conveniently neglected to mention what the "super-secret" tone frequencies were. Needless to say, this was the driving force I needed to really launch an all-out search for those tones, AND HOW Ma Bell uses them. . .NOT to defraud the phone company, just to be able to say, "I know!"

After several months of searching the archives of various collections of electronics publications I found what I was looking for AND MORE!

All right, Mr. Rosenbaum's article was correct in that the whole show starts with 2600 Hz. Now, ever wonder why the common Touchtone (TM) pad came equipped with such an array of wierd tones? I'm referring to those oddball frequencies of 697 Hz, 770 Hz, 1209 Hz, etc. Who was the nut who decided on these particular tones and why? The answer is simple. Touchtone (TM) frequencies were selected so they can in no way interfere with the trunk signaling tones. It soon becomes obvious that the trunk signaling tones were picked first, otherwise we would probably have nice even frequencies in our TT pads.

2-out-of-6 code	Assigned freq (Hz)		# Desired in dialing	Components of desired #
0	700		1 (0 plus 1)	700 + 900
1	900		2 (0 plus 2)	700 + 1100
2	1100		3 (1 plus 2)	900 + 1100
4	1300		4 (0 plus 4)	700 + 1300
7	1500		5 (1 plus 4)	900 + 1300
*	1700		6 (2 plus 4)	1100 + 1300
			7 (0 plus 7)	700 + 1500
			8 (1 plus 7)	900 + 1500
			9 (2 plus 7)	1100 + 1500
			0 (4 plus 7)	1300 + 1500
		Key Pulse	(4 plus *)	1300 + 1700
		Start	(7 plus *)	1500 + 1700

Yes, I hear the shouting, "what are the tones. . .what are the tones?" The trunk signaling tones ARE: 700, 900, 1100, 1300, 1500 and 1700 Hz. Ma Bell assigns these tones numbers, and pairs them together in a two-out-of-six code. The PAIRS are then and only then valid signaling information (see chart).

As shown in the chart, the tones are paired together so that the two-out-of-6 sequence adds up to the number desired in actual dialing. The Key pulse and Start digits are equipment information bits that tell the trunk decoding equipment that a series of tones are coming up or have ended. International country codes ALSO use these same tones, for uniformity.

How The Phone Phreaks Do It

They begin by dialing (on a regular phone) an 800 area code (INWATS) number KNOWN to be registered in a state besides their own. When the distant end begins ringing, then immediately beep out a short burst of 2600 Hz (disconnect tone). The distant end then stops ringing. Next they send out the "key pulse" pair followed by the area code and the number (using tones in above chart). This is followed immediately by the "start" pair. When the distant end rings this time, it is the number they desire, toll free! .

They Get Caught

Ma Bell is always dreaming up super-sophisticated ways of foiling phone phreaks. A couple methods involve the use of 2600 Hz filters on the subscriber side of the line. One method filters out all 2600 Hz coming from the customer end, so the would-be phone phreak never gets off the ground. Another method brings up a central office alarm and seizes the incoming line. Even if the phreak hangs up, his line will remain seized until the phone company can trace him down and ask him what he is using 2600 Hz for!

A loud and clear word of caution: Do not attempt to build, buy, beg, borrow or steal a tone generating device capable of reproducing the tones given in the chart, with the idea in mind of using it to place calls. Such use CONSTITUTES FRAUD AGAINST THE TELEPHONE COMPANY. This article is for educational information only.

. . .WB9FOP

References

ESQUIRE, October 1971, P. 116 "Secrets of the Little Blue Box" by Don Rosenbaum.

73, January 1972, p. 31, "Phone Phreaks VS Ma Bell" by Martin Bradeley Weinstein.

A LITTLE DISSENT

Wayne Green may have a point. If the big magazines, newspapers, etc., are terrified of the IRS its up to the unterrified little guys to speak up. And it may be that a little dissent won't hurt amateur radio.

Anyway, here is a three year renewal to 73 to go along with my subscriptions to QST, Ham Radio and CQ. I think they all have something worthwhile.

M.C. Bowers, Jr. K4VQ

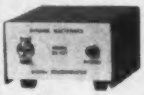
OUR REPEATER IS LICENSED

Enclosed is a check to help defray the cost of your HOTLINE paper which our club would like to subscribe to.

I would also like to take this opportunity to thank you for the information which your magazine covered about 18 months ago about how to license a repeater. I followed this guideline fairly close and was privileged to have the first repeater in the state to be licensed under a WR call. I received the call in about 3 months. A second application filed almost exactly like the first took 53 weeks. This one had to take an all out effort by the FCC to take so long. A couple of letters and a phone call finally woke them up.

Most of the members here take 73. All of us appreciate the efforts that you have made for us and other amateurs.

William C. Cousin



Discriminators for Superior CW reception through QRM & QRN. Plug in installation, one year warranty, 15-day return privilege. Add $2.00 shipping for AC models, $1.00 for DC models.

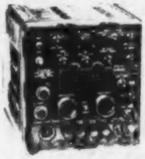
DE-101 for phones only, 115 VAC	$32.95
DE-101A for SPKR & phones, 115 VAC	$43.95
DE-101B for SPKR & phones, 12-18 VDC	$32.95
DE-101C for phones only, 12-18 VDC	$21.95
CB-1 Tested DE-101C circuit board	$15.95 ppd.
CB-2 Tested audio PWR amplifier BD	$11.95 ppd.
CB-3 Tested DE-101B circuit board	$21.95ppd.

Dynamic Electronics, Inc.

Box 1131 Decatur, AL 35601

RECEIVER – TRANSMITTER

R – 392/URR RECEIVER:



High performance, rugged, 32 bands; 500 kHz thru 32 MHz continuous. Mechanical counter type digital readout to 300 Hz. Separate Megacycles and Kilocycles tuning. Triple conversion lower eight bands, double conversion all others. Built in crystal calibrator, squelch, rf gain, audio gain, antenna tuning, BFO, variable selectivity 8, 4, 2 kHz. Requires 22–30 VDC 3 amps. Size: 11½ x 14¼ x 11". WT.: 52 lbs. Shpg. wt.: 65 lbs.

USED, REPARABLE: **$125.00.** *USED, CHECKED:* **$195.00**

T – 195/GRC – 19 TRANSMITTER: 1.5 – 20 MHz, 10 bands. Frequency stability 0.03% plus 1000 Hz. Manual or automatic tuning. CW, voice or FSK operation. Power output: 50 Ohm antenna; 1.5 – 12 MHz 100 watts, 12 – 16 MHz 90 watts, 16 – 20 MHz 80 watts. Input voltage required: 22 – 30 VDC 42 Amps maximum, standby 9 amps. Size: 11½ x 14¾ x 22." Wt.: 122 lbs.; Shpg. Wt.: 150 lbs.
Price: Used – Complete Reparable: **$89.50**

MT – 851 MOUNTING BASE for R-392 & T-195. Shpg. Wt.: 60 lbs. **$10.00**

CX-1599 CABLE, connects R-392 to T-195 – 10" length: **$6.95. BATTERY CABLE** for T-195 w/plug: **$4.95. AN/GRC-19 MANUAL: $8.50. T-195 MAINTENANCE MANUAL: $7.50.**

COMBINATION OFFER: Reparable R-392, T-195, MT-851, CX-1599, T-195. Battery Cable: Special Price complete: **$200.00**

All Prices FOB, Lima OH. Send for FREE CATALOG – Dept. 73

FAIR RADIO SALES

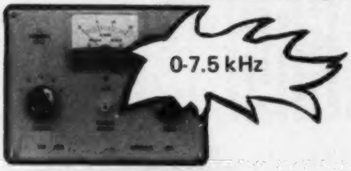
1016 E EUREKA · Box 1105 · LIMA, OHIO · 45802

YOU ASKED FOR IT!

ecm-5B FM modulation meter

Only $99.95

less batteries and crystals



0-7.5 kHz deviation peal
Meets commercial requi
Operates 30-500MHz
Crystal controlled for easy operation
Telescopic antenna

New Options

NICAD power pak $20.46
Charger $29.95
Audio/scope output with earphone $12.95

Write or call for complete info
Send check or money order for $99.95 plus $1.50 for shipping.
Indiana residents add 4% sales tax. Crystals for 146.94MHz: 3.95
All other freq: 7.10

ECM

ECM Corporation
412 N. Weinbach Ave.
Evansville, Indiana 47711

Cash for any Collins military or commercial equipment or parts, [illegible] 61[illegible] [illegible]ceive[illegible] antenna [illegible]. AN/ARC-102. [illegible]/ARC-9[illegible]

CASH

[illegible]/MRC-95. SPACE ELECTRON[illegible] CO.,
[illegible] Brookside Drive, Upper Saddle [illegible], [illegible] 07[illegible]
[illegible] 327-70[illegible]

LOOKING FOR A NEW CHALLENGE?

... then build a TV camera!

ONLY SOLID-STATE CAMERA AVAILABLE IN KIT FORM OR FACTORY ASSEMBLED COMPLETE KIT WITH VIDICON TUBE ONLY $166.00 POSTPAID DELIVERY ANYWHERE IN USA, CANADA and MEXICO. OPTIONAL AUDIO SUBCARRIER $18.9 WRITE or PHONE NOW FOR COMPLETE CATALOG OF KITS, PARTS and PLANS. DIAL 402-987-3771

1301 N. BROADWAY ATV Research DAKOTA CITY, NEBR. 68731

Isolated - Pad - Drill - Mill

Precision circuit board construction without etching. Fits hand drill, electric drill. Simple, fast, economical, safe.
Sizes. .20, .15, .10 inch dia.
With replaceable #60 drill.

$6.95 ea.
Calif. residents add 5%.

AFS A F STAHLER Co

PO BOX 354 CUPERTINO, CALIF 95014

PRINTED CIRCUIT TECHNIQUES FOR THE HOBBYIST

BOOKLET: $2.00
ARTWORK, PC DRILL BITS:
SEND SASE FOR FLYER.

TRUMBULL, 833 BALRA DR.,
EL CERRITO, CA. 94530

WORLD QSL BUREAU

5200 Panama Ave., Richmond CA USA 94804

THE ONLY QSL BUREAU to handle all of your QSLs to anywhere; next door, the next state, the next county, the whole world. Just bundle them up (please arrange alphabetically) and send them to us with payment of 6¢ each.

PARTS! CORNELL TUBES!

FREE Send For FREE
CORNELL'S
New Color
Catalog
48 Pgs. New Items

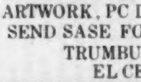
33¢ per tube
IN LOTS OF 100

36¢ per tube

ORDER FREE IF NOT SHIPPED IN 24 HOURS!

4215 S University Ave. San Diego, Calif. 92105

SST T-1 RANDOM WIRE ANTENNA TUNER



All band operation (80-10 meters) with most any random length wire. 200 watt power capability. Ideal for portable or home operation. A must for Field Day. Size: 2 x 4¾ x 2-3/8. Built-in neon tune-up indicator. Guaranteed for 90 days.

COMPACT – EASY TO USE.

• • • only $24.95

POSTPAID. (ADD SALES TAX IN CALIF.)

SST Electronics, P.O. Box 1, Lawndale CA 90260

73 Books & Stuff

the Books

HOT OFF THE PRESSES!

PRACTICAL TEST INSTRUMENTS YOU CAN BUILD

$4.95

37 simple test instruments you can make — covers VOMs, VTVMs, semiconductor testing units, dip meters, watt meters, and just about anything else you might need around the test lab and ham shack.

RF & DIGITAL TEST EQUIPMENT YOU CAN BUILD

$5.95

RF burst, function, square wave generators, variable length pulse generators — 100 kHz marker, i-f and rf sweep generators, audio osc, af/rf signal injector, 146 MHz synthesizer, digital readouts for counters, several counters, prescaler, microwavemeter, etc. 252 pages.

ORDER NOW!

EXTRA CLASS STUDY GUIDE

$7

Does the theory required for the Extra Class exam panic you? No need, for this book reduces it to easy comprehension. Many amateurs find that a quick reading through this book is enough to get them through the tough Extra Class exam. Face that exam with confidence.

FM REPEATER CIRCUITS MANUAL

hardbound $7
softbound $5

Contains almost every conceivable circuit that might be needed for use with a repeater. All circuits explained in detail. All aspects covered, from the operator to the antenna. Also contains chapters on setting up a mobile station, plus much more.

HOW TO USE FM

$1.50

This book presents the basics of two meter FM operation and repeaters in short form with the end in mind of getting you on FM quickly and easily.

It is easy to make some blunders when you are getting started with anything new. It is also embarrasing. A fast reading of this book should help you avoid the pitfalls.

VHF PROJECTS FOR AMATEUR AND EXPERIMENTER

$5

A must for the VHF op. Opening chapters on operating practices and getting started in VHF, both AM and FM, followed by 58 chapters on building useful test equipment, modifying existing and surplus gear, building complete stations, both fixed and portable, linears, converters, control units, preamps, band scanners, antennas, noise suppression, plus many more.

FASCINATING WORLD OF RADIO COMMUNICATIONS

$4

All about broadcast band DXing, tuning the tropical DX bands, DXing radio amateurs, antennas for shortwave, radio licenses, pioneers in electricity and radio, commercial broadcast stations, WWV, etc.

TVI

$1.50

Discusses all types of interference problems in great detail with recommended steps to cure these problems. Good for both the amateur and citizens band operator. Try this cure and suffer no longer.

IC PROJECTS

$4

This book tells how to understand and use ICs, with numberous construction projects.

1974
FM REPEATER ATLAS

$1.50

Listings by states (or countries) and cities of all repeaters, both open and closed, in the world. Periodically updated. Handy size for mobile use.

SOLID STATE PROJECTS

$4

More than 60 projects of interest to anyone in electronics. The devices range from a simple transistor tester to a ham TV receiver. This collection will help you become more intimately acquainted with zeners, ICs and varactors, etc.

TRANSISTOR PROJECTS

$3

Crammed full of home construction projects, from receivers to transmitters and all in between. Chapters include such articles as zener diodes, how they work, how to use, test and buy them; integrated circuits; how to design transistor amplifiers; and many more.

DX HANDBOOK with MAP

$3

How to work DX, how to get QSL'S, country lists, award lists, QSL bureaus, maps of the world, great circle maps centered on major U.S. cities, DX bearing charts for major U.S. cities, how to go on your own DXpedition, and much more. Wall size DX map of the world included.

more Books

INTRODUCTION TO RTTY

$1

In this book the world of radioteletype is explained in an easily understood manner for the beginner. There's also a chapter on RTTY Art which will teach you everything you need to know in order to be a RTTY Artist. The last part of this book contains a bibliography of everything published about RTTY since 1952.

RTTY HANDBOOK

$6

A comprehensive book covering all areas of radio teletype, from getting started with the basic principles, what equipment to procure and how to make it work. The only up-to-date book available on the subject. Well written, easy to read and understand.

73 USEFUL TRANSISTOR CIRCUITS

$1

Useful transistor circuits for audio, receivers, transmitters and test equipment. 47 chapters with circuit diagrams for each, complete with component values, etc. A must for the solid state home brewer. Easy to read and to understand.

SLOW SCAN TELEVISION HANDBOOK

hardbound $7
softbound $5

This excellent book tells all about it, from its history and basics to the present state-of-the-art techniques. Contains chapters on circuits, monitors, cameras, color SSTV, test equipment and much more.

DIODE CIRCUITS HANDBOOK

$1

115 diode circuits including power supply application, regulators, ac meter applications, receiver detectors for AM-FM-SSB, noise limiters, squelch, AGC, varicap tuning, audio clippers, compressors FM modulators, RTTY keying, varactor multipliers, noise generators.

VHF ANTENNA HANDBOOK

$3

Would you believe that the secret to success in VHF/UHF is in the antenna system? This is no earth shaking discovery, but it's true. A complete, detailed book with descriptions, dimensions, tuning data, diagrams and photos. Antennas from the instant coathanger to the giant collinear beam can be found here.

DIGITAL CONTROL OF REPEATERS

hardbound $7
softbound $5

Here's a book for the FMer who wants to design and build a digital repeater control system. Contains sections on repeaters, basic logic functions, logic circuit design, control systems, support circuits, mobile installations, touch-tone, plus a special section on a "mini" repeater control system.

COAX HANDBOOK

$3

All about coaxial cables, connectors and applications. It's all here — pictures, part numbers and specifications for all types. Includes lengths for different types for quarter, half and full wave feedlines. If you use coax you cannot possibly function confidently without this book.

SIMPLIFIED MATH FOR THE HAMSHACK

$.50

Mathematics made easy by explaining each step in each operation. Simplifies most calculations so they may be handled in your head. Explanations of exponents; their multiplication, division, addition, subtraction, squares, roots and powers. Algebraic manipulations with rules and problems. Slide rule instructions.

C.W. MANUAL, RADIO TELEGRAPHY

$.50

Chapters on history of C.W., learning the code, hand keying, Q signals, head reading and copying behind, semi-automatic keys, electronic keyers, keying the transmitter, etc. Very informative with plenty of proven tips on improving your sending and receiving abilities.

VHF ANTENNA HANDBOOK

$3

Would you believe that the secret to success in VHF/UHF is the antenna system? This is no earth shaking discovery, but it's true. A complete detailed book with descriptions, dimensions, tuning data, diagrams and photos. Antennas from the instant coathanger to the giant collinear beam can be found here. Your antenna is the cheapest amplifier you can build.

QUESTIONS AND ANSWERS

$2

Discussions of transmitting, receiving, antennas, power and audio measurement devices, etc. Circuits, gadgets, small construction projects, with complete diagrams. A wealth of interesting information.

ADVANCED CLASS STUDY GUIDE

$4

Thousands have used this book to help them breeze through the Advanced exam with no strain. This is the ONLY study guide published which covers ALL the material you will have to know.

GENERAL CLASS STUDY GUIDE

$6

This book will help you to really understand the theory and enable you to easily pass the FCC exam. This is not a Q&A manual for memorization. Study this book and go into the exam with confidence.

NOVICE CLASS STUDY GUIDE

$4

The world's easiest to understand book on the theory required for the Novice amateur radio license exam. Frustrated by fundamentals? Read this book. One simple reading should carry you through the exam.

the Stuff

73 CERTIFICATES

WAAS $1

Worked Almost All States — Proof of your having worked 49 of the 50 states. It is for those who are just unable to get that last state confirmed.

ALL MODE DXDC $1

How many can qualify for this one? An award for 2-way communications with 10 countries using CW-SSB-RTTY-SSTV modes.

the Stuff
(continued)

DXDC $1

Available for those who present proof of contact (copy of log) with 10 different countries. Awarding this certificate makes you a member of the DX Decade Club.

RTTY-DXDC $1

Frame and hang this one above your machine. All operating award for those who have submitted proof of 2-way teletype communications with 10 countries. Endorsement provisions for different bands.

SSTV-DXCC $1

Dress up the shack with this award for 2-way Slow Scan Television communications with 10 countries. Endorsement provisions for separate bands.

U.S. MAPS
$1

These wall sized maps show the states and call area. They are specially designed for coloring to show your progress toward the Worked All States award of ARRL or the Worked Almost All States award put out by 73 (for proof of contact with 49 states). Since you will probably be wanting to work for the award on several bands you will want several maps. They come in groups of four.

WORLD DX MAP
$2

This is the same wall-sized DX map that is included with the DX Handbook except it comes to you rolled up instead of folded. This is so you can put it on the wall or have it framed. The map is designed with all country prefixes indicated and space for you to color in the countries as you work them. Visitors can see immediately how much of the world you have contacted! The zones are on the map as well as prefixes. Maybe you need several maps.

CUSTOMIZED DX BEARING CHART
$4

An amateur who works for a big computer company has a program which permits him to plug in your location and have it print out the bearings of all the countries of the world from your shack. Once you have this list you will use it for every DX contact. The chart gives the bearing and distance to all major cities and countries. Be patient when you order for these have to be run through in groups so that we can offer them to you at such a low cost.

73 BINDERS
$5

These binders are a gorgeous red and come with the nicest set of year stickers you've ever seen. The perfect thing for storing your issues of 73 so that they won't get lost or spilt on, or into the hands of the Jr. Op. Dress up your shack with these binders.

LAPEL BADGES
$1

Name and call identifies you at club meetings, hamfests, busted pot parties. Hand engraved by skilled New Hampshire craftsman with loving care. Only one lousy dollar. Send first name and call.

CALL LETTER DESK PLATE
$2

How about dressing up your operating table with a desk plate showing your first name and call? These embossed desk plates are nice — and inexpensive. No zero available, sorry. There is room for twenty letters and spaces total.

---

73 Magazine, Peterborough NH 03458

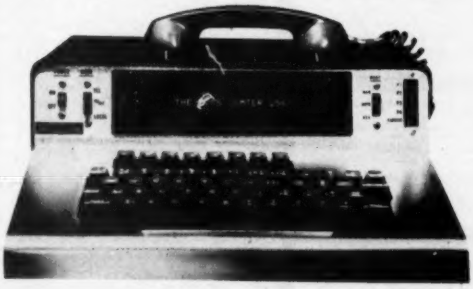
NAME ____________________
ADDRESS ____________________
CITY __________ STATE ______ ZIP ________
SEND ME: PRICE:
____________________ ________
____________________ ________
____________________ ________
____________________ ________
SIGNATURE ____________________
CARD # ____________________
EXPIRATION DATE __________ TOTAL ENCLOSED ________

☐ master charge ☐ BANKAMERICARD

Why Is Tom Durston Smiling?

Tom Durston is an engineer at MITS, Inc. He's walking around these days with a big grin on his face. And he has plenty of reason.

Tom has designed a computer terminal called the Comter 256. It's the same terminal that is featured on the cover of this month's *Radio Electronics.* And it's the first computer terminal to be marketed in kit form. Anywhere.



When Tom says, the Comter 256 is a "low cost, high performance computer terminal", he isn't using rhetoric. Just look at the specs:

The MITS Comter 256 also has a tape play/record feature, giving it virtually unlimited memory capability. Almost any type of tape recorder may be used.

The ASCII coded keyboard and 110/300 band transmit/receive rate makes the terminal compatible with almost all systems today.

A hardwire in/out connection on the back of the unit allows direct wiring to a computer. The same connector will be used for add on features such as an RS232 connection and modification from full duplex to half duplex transmission.

The Comter 256, has an alphanumeric, thirty-two character Self-scan™ display. The terminal will store 256 characters with expandability to 1,024 characters.

The built-in acoustic coupler makes computer hookup much simpler, saves extra cost, and eliminates external connections.

The auto-transmit feature allows the operator to transmit data or program material to the computer line by line instead of typing it directly into the computer, saving computer time and your money.

And when Tom says, "The Comter 256 was created to give everyone access to the sophisticated world of computers" . . . Well, just look at the PRICES:

Comter 256, kit form, complete with easy-to-follow manual	$495.00
Comter 256, fully assembled	$695.00
Memory Expansion — per page (256 characters)	$ 79.50
Memory Expansion — complete 3 page	$230.00

MITS INC.®

"Creative Electronics"

Prices, specifications and delivery subject to change without notice.

☐ Enclosed is a Check for $ ____________

or ☐ BankAmericard # ____________

or ☐ Master Charge # ____________

Credit Card Expiration Date

Include $3.00 for Postage and Handling

☐ CT 256

☐ **Please send information on Entire MITS Line.**

☐ Kit

☐ Assembled

☐ One Page Expansion

☐ Three Page Expansion

73-11-74

NAME ____________

ADDRESS ____________

CITY ____________

STATE & ZIP ____________

MITS/6328 Linn, N.E., Albuquerque, New Mexico 87108 505/265-7553

INTERNATIONAL ELECTRONICS UNLIMITED

DIGITAL INTEGRATED CIRCUITS

	Ea.		Ea.		Ea.
7400	$ .19	7447	$1.15	74141	$1.23
7401	.19	7448	1.15	74145	1.15
7402	.19	7450	.24	74150	1.09
7403	.19	7451	.27	74151	.89
7404	.22	7453	.27	74153	1.29
7405	.22	7454	.39	74154	1.59
7406	.39	7460	.19	74155	1.19
7407	.39	7464	.39	74156	1.29
7408	.25	7465	.39	74157	1.29
7409	.25	7472	.36	74161	1.39
7410	.19	7473	.43	74163	1.59
7411	.29	7474	.43	74164	1.89
7413	.79	7475	.75	74165	1.89
7415	.39	7476	.47	74166	1.65
7416	.39	7483	1.11	74173	1.65
7417	.39	7485	1.39	74176	1.09
7420	.19	7486	.44	74177	.99
7422	.29	7489	2.75	74180	1.09
7423	.35	7490	.76	74181	3.65
7425	.39	7491	1.29	74182	.89
7426	.29	7492	.79	74184	2.69
7427	.35	7493	.79	74185	2.19
7430	.22	7494	.89	74190	1.59
7432	.29	7495	.89	74191	1.59
7437	.45	7496	.89	74192	1.49
7438	.39	74100	1.65	74193	1.39
7440	.19	74105	.49	74194	1.39
7441	1.09	74107	.49	74195	.99
7442	.99	74121	.57	74196	1.09
7443	.99	74122	.53	74197	.99
7444	1.10	74123	.99	74198	2.19
7445	.99	74125	.69	74199	2.19
7446	.99	74126	.79	74200	7.95

LOW POWER TTL

74L00	.33	74L51	.33	74L90	1.69
74L02	.33	74L55	.33	74L91	1.45
74L03	.33	74L71	.33	74L93	1.69
74L04	.33	74L72	.49	74L95	1.69
74L06	.33	74L73	.69	74L98	2.79
74L10	.33	74L74	.69	74L164	2.79
74L20	.33	74L78	.79	74L165	2.79
74L30	.33	74L85	1.25		
74L42	1.69	74L86	.69		

HIGH SPEED TTL

74H00	.33	74H21	.33	74H55	.39
74H01	.33	74H22	.33	74H60	.39
74H04	.33	74H30	.33	74H61	.39
74H08	.33	74H40	.33	74H62	.39
74H10	.33	74H50	.33	74H72	.49
74H11	.33	74H52	.33	74H74	.59
74H20	.33	74H53	.39	74H76	.59

8000 SERIES TTL

8091	.59	8214	1.69	8811	.69
8092	.59	8220	1.69	8812	1.10
8095	1.39	8230	2.59	8822	2.59
8121	.89	8520	1.29	8830	2.59
8123	1.59	8551	1.65	8831	2.59
8130	2.19	8552	2.49	8836	.49
8200	2.59	8554	2.49	8880	1.33
8210	3.49	8810	.79		

9000 SERIES TTL

9002	.39	9309	.89	9601	.99
9301	1.14	9312	.89	9602	.89

Please specify data sheets required with order. Add $.50 per data sheet for items priced less than $1.00 each.

CMOS

74C00	.39	74C74	1.15	74C162	3.25
74C02	.35	74C76	1.70	74C163	3.25
74C04	.75	74C107	1.50	74C164	3.50
74C08	.75	74C151	2.90	74C173	2.90
74C10	.65	74C154	3.50	74C195	3.00
74C20	.65	74C157	2.19	80C95	1.50
74C42	2.15	74C160	3.25	80C97	1.50
74C73	1.55	74C161	3.25		

4000 SERIES RCA EQUIVALENT

CD4001	.55	CD4013	1.20	CD4023	.55
CD4009	.85	CD4016	1.25	CD4025	.55
CD4010	.85	CD4017	2.95	CD4027	1.35
CD4011	.55	CD4019	1.35	CD4030	.95
CD4012	.55	CD4022	2.75	CD4035	2.85

MEMORIES

1101	256 bit RAM MOS	1.75
1103	1024 bit RAM MOS	4.95
5260	1024 bit RAM Low Power	3.95
7489	64 bit RAM TTL	2.75
8223	Programmable ROM	4.95

10% OFF ON ORDERS OVER $25.00

LOGIC PROBE KIT

- Ten nano/sec capability
- Checks TTL & DTL logic
- Dual slope memory
- Internal 5V regulator

Kit is complete with all necessary components, case, probe, complete instructions and logic chart. $19.95

TRANSISTOR GRAB BAG

PNP & NPN
Yield 50% + Good
Good for use as segment drivers 30/$1.00

POWER SUPPLY SPLITTER KIT

- Ground reference for positive & negative output from single supply — any DC source to 20V
- Balanced output adjustment
- 1 amp-current capability with sink
- increase usefulness of your power supply

Complete with all components & instructions $4.95

18 PIN CALCULATOR KIT

- MM 5736 18 PIN Calc. Chip four function 6 Digit
- A pair of 3-in-1 PAKS (6 digit) LED NSN 33
- One 75492 HEX Digit driver

Schematic and instructions included. You supply switches, keyboard and battery for complete calculator. $9.95

CALCULATOR CHIPS

5001	LSI (40-Pin) Add, subtr., mult. & div., 12-dig. Data supplied with chip	$3.95 ea.
	Data only — Refundable with purchase	1.00
5002	LSI similar to 5001 exc. des. for battery operated - Data supplied with chip	7.95 ea.
	Data only — Refundable with purchase	1.00
5005	LSI (28 pin) Full 4 funct. mem. 12-dig. displ. & calc. 7 seg. mltplx. outp. Data suppl. w/chip	8.45 ea.
	Data only — Refundable with purchase	1.00
MM5736	18 Pin, 6-dig., add, subtr., mult., div.	3.95 ea.

DIGITAL CLOCK CHIPS

MM 5311	28-pin any readout 6-dig. BCD mux with spec. sheet	9.95 ea.
MM 5312	24-pin any readout 4 digit 1pps output BCD mux with spec. sheet	6.95 ea.
MM 5313	28-pin any readout 6 digit 1pps BCD mux with spec. sheet	7.95 ea.
MM 5314	24-pin LED-incandescent readout mux 6-digit with spec. sheet	8.95 ea.
MM 5316	40-pin norm. alarm set snooze alarm-timer 12 or 24-hr. operat. with spec. sheet	12.95 ea.

LEDS

MV108	Visible red TO 18		.25 ea.
MV50	Axial leads micromini dome	.25 ea.	5/1.00
MV5020	Jumbo clear dome visible red	.35 ea.	3/1.00
ME4	Infra red (invisible) diff. dome		.60 ea.

DISPLAYS

MAN1	Red, 7 seg., .270"	$2.50 ea.
MAN2	Red alpha numeric, .32"	4.95 ea.
MAN3A	Red, 7 seg., .127" in line leads	.79 ea.
MAN3M	Red, 7 seg., .127" staggered leads	1.15 ea.
MAN4	Red, 7 seg., .190"	2.15 ea.
MAN5	Green, 7 seg., .270"	2.95 ea.
MAN7	Red, 7 seg., .270"	1.39 ea.
MAN8	Yellow, 7 seg., .270"	3.95 ea.
MAN66	.75" high direct viewing LED	4.65 ea.
DL707	Red, 7 seg., .3"	2.15 ea.

OPTO ISOLATORS

MCD2	Diodes	$1.09 ea.
MCT2	Transistor	.69 ea.

PHASE LOCKED LOOPS

560	Phase Locked Loop	DIP	2.75 ea.
561	Phase Locked Loop	DIP	2.75 ea.
562	Phase Locked Loop	DIP	2.75 ea.
565	Phase Locked Loop	DIP	2.63 ea.
566	Function Generator	MINI DIP	2.75 ea.
567	Tone Generator	MINI-DIP	2.95 ea.

LINEAR INTEGRATED CIRCUITS

300	Pos V Reg (super 723)	TO-5	$ .79 ea.
301	Hi performance AMP	MINI-DIP, TO-5	.32 ea.
302	Voltage Follower	TO-5	.79 ea.
304	Negative Voltage Regul.	TO-5	.89 ea.
305	Positive Voltage Regul.	TO-5	.95 ea.
307	Op AMP (super 741)	MINI-DIP, TO-5	.35 ea.
308	Micro Power Op Amp	MINI-DIP	1.10 ea.
309H	5 V Regulator 200 ma	TO-5	1.10 ea.
309K	5 V 1A Regulator	TO-3	1.65 ea.
310	Voltage Follower Op Amp	TO-5	1.19 ea.
311	Hi perf. Volt. Compartr.	MINI-DIP, TO-5	1.05 ea.
319	Hi-Speed Dual Compartr.	DIP	1.29 ea.
320	Neg. Reg. 5.2, 12, 15	TO-3	1.35 ea.
324	Quad Op Amp	DIP	1.95 ea.
339	Quad Comparator	DIP	1.69 ea.
340T	Pos. Volt. Reg. (6V-8V-12V-15V-18V-24V)	TO-220	1.95 ea.
370	AGC/Squelch AMPL	TO-5 or DIP	1.15 ea.
372	AF-IF Strip-detector	DIP	.79 ea.
373	AM/FM/SSB Strip	DIP	3.25 ea.
376	Pos. Volt. Regulator	MINI-DIP	.59 ea.
377	2W Stereo amp	DIP	2.69 ea.
380	2 Watt Audio Amp	DIP	1.29 ea.
380-8	.6W Audio amp	MINI-DIP	1.25 ea.
381	Low-Noise Dual Pre-Amp	DIP	1.79 ea.
382	Low-Noise Dual Pre-Amp	DIP	1.79 ea.
550	Prec. Voltage Regulator	DIP	.79 ea.
555	Timer	MINI-DIP	.99 ea.
703	RF-IF AMP	MINI-DIP	.45 ea.
709	Operational AMPL	TO-5 or DIP	.29 ea.
711	Dual Different. Compar.	DIP	.29 ea.
723	Voltage Regulator	DIP	.59 ea.
739	Dual Hi Perf. Op AMP	DIP	1.19 ea.
741	Comp. Op AMP	MINI-DIP, TO-5	.35 ea.
747	Dual 741 Op Amp	TO-5 or DIP	.79 ea.
748	Freq. Adj. 741	MINI-DIP	.39 ea.
1303	Stereo Pre-Amp	DIP	.89 ea.
1304	FM Mulpx Stereo Demod	DIP	1.19 ea.
1307	FM Mulpx Stereo Demod	DIP	.82 ea.
1458	Dual Comp. Op. Amp.	MINI-DIP	.69 ea.
LH2111	Dual LM 211 Volt. Comp.	DIP	1.95 ea.
3065	TV-FM Sound System	DIP	.69 ea.
3075	FM Det.-LMTR & Audio Pre-Amp	DIP	.79 ea.
3900	Quad Amplifier	DIP	.59 ea.
3905	Precision Timer	DIP	.65 ea.
7524	Core Mem Sense AMPL	DIP	1.89 ea.
7525	Core Mem Sense AMPL	DIP	.89 ea.
7534	Core Mem Sense Amp	DIP	2.59 ea.
7535	Core Mem Sense Amp	DIP	1.15 ea.
8038	Function Generator	DIP	4.95 ea.
75451	Dual Peripheral Driver	MINI-DIP	.39 ea.
75452	Dual Peripheral Driver	MINI-DIP	.39 ea.
75453	(351) Dual Periph. Driver	MINI-DIP	.39 ea.
75491	Quad. seg. driver for LED readout	DIP	1.55 ea.
75492	Hex digit driver	DIP	1.69 ea.

Please specify which data sheets are required with order. Add $.50 per data sheet for items priced less than $1.00 each.

TRANSISTOR SPECIAL

Hi Voltage Power Transistors — Prime Quality

Typically 40 Beta at 50 MHz. 10W, 1A max TO-5

NPN	400 VOLT	$2.45 ea.	With combined
NPN	300 VOLT	1.20 ea.	total of 100
NPN	200 VOLT	.75 ea.	trans — 15% Off

(408) 659-4773

All items are new, unused surplus parts—tested functional. Satisfaction is guaranteed. Shipment will be made via first class mail — postage paid — in U.S., Canada and Mexico within three days from receipt of order. Minimum order — $5.00. California residents add sales tax.

INTERNATIONAL ELECTRONICS UNLIMITED
P.O. BOX 1708 MONTEREY, CALIF. 93940 USA

ADD A DIGITAL CLOCK TO YOUR SHACK

6 DIGIT CLOCK KIT

Contains – MM5313 – 6 MAN7 – all digit interface
IC's and all components needed
less pwr xfmr and case $27.95

4 DIGIT CLOCK KIT

Contains – MM5312 – 4 MAN7 – all digit interface
IC's and all components needed
less pwr xfmr and case $22.95

NOVEMBER $PECIAL$ NOVEMBER

IN4148	Silicon Signal Switching Diode	15/1.00
TIS97 - TIS98 NPN	Transistor	10/1.00
7400 - 7401 - 7403	GATES	6/1.00
7404 - 7410 - 7420	GATES	5/1.00
LM301H/LM301N	OP. AMP.	3/1.00
LM309K	5 V 1 AMP	1.25
LM311H/LM311N	Comparators	1.00
LM380N	2 Watt Audio AMP	1.25
LM3900N	Quad AMP DIP	.55
LM3905N	Precision Timer	.65
LM741CH/LM741CN	OP. AMP.	3/1.00
MM5314	24 Pin Digital Clock Chip	7.95
MM5316	40 Pin Alarm Clock Chip	11.95
MM5016H	512 Bit Dynamic Shift Reg.	2.00
MM1103	1024 X 1 Bit Dynamic RAM	3.95
2519	40 X 6 Static Shift Register	4.00
2529	240 X 2 Static Shift Register	5.00

LINEAR

LM300	Pos. V Reg To 5	$ .85
LM301H/N	Improved Op Amp	.40
LM302H	Voltage Follower	.85
LM304H	Negative Voltage Regulator	1.10
LM305H	Positive Voltage Regulator	1.00
LM307H/N	Op Amp (Super 741)	.40
LM308H/N	Micro Power Op Amp	1.15
LM309K	5 Volt Regulator / Amp	1.70
LM310H	Improved Volt. Follwer Op Amp	1.35
LM311H/N	Hi-performance Volt. Comp.	1.15
LM319H	Hi-Speed Dual Comp.	1.55
LM320K-5V-15V	— To 3 Neg. Regulator	1.75
LM324N	Quad 741 Op Amp	1.90
LM339	Quad Comparator	2.35
LM340K-5V-12V-15V-24	Positive Volt Regulator	2.00
LM370N	A 6 C - Squelch Amp.	1.55
LM373N	AM/FM $$ B Strip	3.30
LM380N	2 Watt Audio Power Amp	1.50
LM703H	RF/IF Amp	.45
LM5558V	Dual Op Amp	1.00
LM741H/N	Comp. Op Amp	.40
LM747H/N	Dual Compen. Op Amp	.90
LM748N	Freq. Adj. 741	.40
LM1458N	Dual Comp. Op Amp	.65
LM3065N	T.V.-FM Sound System	.75
LM3900N	Quad Amp	.65
LM555N	Timer	1.00
LM565-LM566-LM567	Phase Looked Loops	2.50ea
LM 7522	Core Memory Sense Amp.	2.50
LM 7524	Core Memory Sense Amp.	1.50
LM 7535	Core Memory Sense Amp.	1.00
LM75451	Dual Peripheral Driver	.49
LM75452	Dual Peripheral Driver	.49
LM75453	Dual (LM351)	.65

DIP SOLDER TAIL SOCKETS
DUAL IN-LINE SOLDER TAIL SOCKETS
GOLD CONTACTS

8 PIN	.44	18 PIN	.74	28 PIN	1.30
14 PIN	.52	22 PIN	1.00	36 PIN	1.56
16 PIN	.54	24 PIN	1.05	40 PIN	1.75

Also available - wire wrap sockets - 1/2/3 levels write or call for large volumn DISCOUNTS

T T L

7400	$ .18	7453	$ .27	74157	$1.56
7401	.23	7454	.40	74160	1.65
7402	.23	7459	.25	74161	1.66
7403	.23	7460	.25	74163	2.50
7404	.25	7470	.45	74164	2.50
7405	.24	7472	.41	74165	2.50
7406	.50	7473	.47	74166	1.75
7407	.50	7474	.47	74170	3.00
7408	.25	7475	.90	74173	1.75
7409	.25	7476	.47	74174	1.85
7410	.23	7480	.50	74175	1.85
7411	.30	7482	1.75	74176	.85
7413	.89	7483	1.15	74177	.85
7416	.45	7485	1.10	74180	1.06
7417	.45	7486	.47	74181	3.75
7418	.25	7488	4.00	74182	1.00
7420	.23	7489	3.00	74184	2.30
7421	.27	7490	.89	74185	2.30
7423	.32	7491	1.15	74187	7.00
7425	.27	7492	.95	74190	1.50
7426	.31	7493	.95	74191	1.50
7427	.32	7494	.97	74192	1.50
7429	.40	7495	.95	74193	1.50
7430	.33	7496	.95	74194	1.50
7432	.26	74100	1.50	74195	1.06
7437	.45	74107	.47	74196	1.25
7438	.50	74121	.55	74197	1.06
7439	.50	74122	.47	74198	2.25
7440	.23	74123	1.05	74199	2.75
7441	1.10	74125	.60	74200	7.00
7442	1.05	74126	.80		
7443	1.10	74141	1.15		
7444	1.15	74145	1.15		
7445	1.10	74150	.95		
7446	1.25	74151	1.20		
7447	1.25	74153	1.50		
7448	1.25	74154	1.25		
7450	.25	74155	1.30		
7451	.27	74156	1.30		

PROJECTS

8263 Sig.	7.00
8267	4.00
2513	14.00
2518	7.00
2424	7.00
2425	7.00
4024	2.25

CMOS

CD4001	$ .56
CD4002	.55
CD4009	1.40
CD4010	.60
CD4011	.55
CD4012	.55
CD4013	1.50
CD4016	1.40
CD4023	.56
CD4025	.56
CD4027	1.25
CD4030	.60
74C00	.45
74C04	.70
74C20	.65
74C173	2.60

8000 Series

8090	$ .35
8091—8098	.55
8223	5.00
8260	.75
8266	1.15
8880	1.35

Many Other 8000 Series

LEDS

MV 10	5/1
MV 50	6/1
MV 5024	5/1
MAN-1	1.95
MAN-3	.95
MAN-4	1.95
MAN-7	1.50
DL 33	1.95

20% Discount for 100 Pieces Combined — Above 7400 Series

Satisfaction guaranteed. All items 100% tested. $5.00 minimum order, First Class Mail — No extra charge. California residents add 6% sales tax. Wholesale outlets — write for special discounts. Write for FREE catalog . . . data sheets $.20 each.

JAMES
Electronics

P. O. Box 822—Belmont, Ca. 94002
PHONE ORDERS WELCOME
(415) 592-8097

microsystems international
MH89 J

The Hybrid Analog TONE GENERATOR

MH8913J $18.00

microsystems international
MH8900

DATA and APPLICATION SHEETS FURNISHED WITH ORDER

general specifications

Frequency Drift[1]: < 1.5%

Group Amplitude Stability: ±25%

Total Distortion (Harmonic + Intermodulation): < 5% (relative to level of fundamental frequencies)

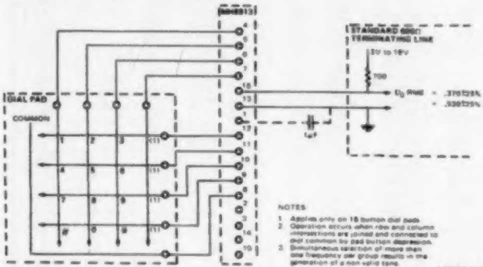
Typical Rise Time to Specified Output and Frequency:

1) Frequency selected, power supply switched < 5ms
2) Power applied, frequency selector switched < 2ms
3) Power applied, frequency within same group changed < 2μs

features

- Dual Frequency Capability
- Standard Telephone Tone-Dial Frequencies: Low Group – 697, 770, 852, 941 Hz; High Group – 1209, 1336, 1477, 1633 Hz
- Specification Ratings Exceed CCITT Recommendations

typical circuit connection diagram

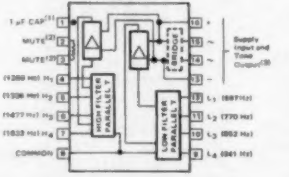

MH8913
DIAL PAD
COMMON
1
2
3
4
5
6
7
8
9
#
0
*
(1)
STANDARD 600Ω TERMINATING LINE
3V to 18V
700
V_0 RMS = .370±25% LOW GROUP
= .530±25% HIGH GROUP
1μF

NOTES

1 Applies only on 16 button dial pads
2 Operation occurs when row and column intersections are joined and connected to dial common by pad button depression.
3 Simultaneous selection of more than one frequency per group results in the generation of a non valid tone.

block diagram and pin configuration

(Top View)


1 μF CAP(1)
MUTE(2)
MUTE(2)
(1209 Hz) H_1
(1336 Hz) H_2
(1477 Hz) H_3
(1633 Hz) H_4
COMMON
HIGH FILTER PARALLEL T
LOW FILTER PARALLEL T
BRIDGE
+
~
~
−
Supply Input and Tone Output(3)
L_1 (697 Hz)
L_2 (770 Hz)
L_3 (852 Hz)
L_4 (941 Hz)

MH8913J CAN BE USED WITH CHOMERICS #ER21624 TOUCH TONE KEYBOARD

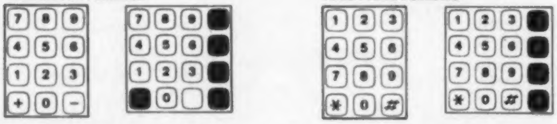
CHOMERICS

QUICKEY® TACTILE KEYBOARDS

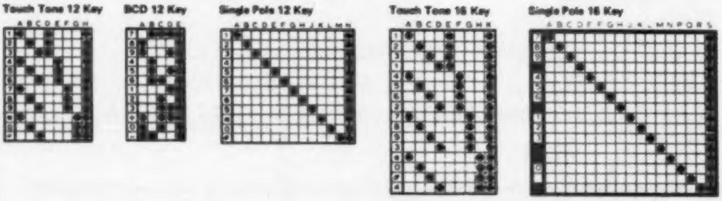
FORMATS
Standard legends are black and white set in Standard Medium type.

CALCULATOR FORMATS

TOUCH TONE FORMATS


7 8 9
4 5 6
1 2 3
+ 0 −
7 8 9
4 5 6
1 2 3
0
1 2 3
4 5 6
7 8 9
* 0 #
1 2 3
4 5 6
7 8 9
* 0 #

CODING


A B C D E F G H
A B C D E
A B C D E F G H J K L M N
A B C D E F G H K
A B C D E F G H J K L M N P Q R S

Touch Tone 12 Key

BCD 12 Key

Single Pole 12 Key

Touch Tone 16 Key

Single Pole 16 Key

1/2" centers Model #	Price	3/4" centers Model #	Price	Format	Coding	# of Keys
ER 21622	7.15	ER 21605	7.70	Touch tone	Single pole	12
ER 21623	8.70	ER 21606	9.25	Touch tone	Touch tone	12
ER 21624	9.25	-	-	Touch tone	Direct to MH8913	12
-	-	ER 21607	7.70	Calculator	Single pole	12
-	-	ER 21608	11.00	Calculator	BCD	12
ER 21625	8.70	ER 21609	9.25	Calculator	Single pole	16
-	-	ER 21610	9.25	Touch tone	Single pole	16
-	-	ER 21611	11.15	Touch tone	Touch tone	16

KA CATALOG 25¢ OR FREE WITH ORDER

ELECTRONICS FOR THE HAM and EXPERIMENTER

KA ELECTRONIC SALES

1220 MAJESTY DR · DALLAS, TEXAS 75247
(214) 634-7870
TWX 910·861·9028

SOLID STATE SURPLUS
. . . . four months later

Dear Customer,

Four months ago we ran our first ad in these pages. You may even remember the "just what the world needs. . .another surplus place?" banner which said, in effect, we aim to do things a little differently.

Those of you who have ordered from us know what we're about. . .hobbyist parts at truly competitive prices, fast turnaround, no backordering. . .and judging from your reaction, this is what you want.

For those reading about us for the first time, a few comments. One, we *do not publish a catalog*, for two reasons. First, our "catalog" is this page – it lists every product we sell. (A couple of months ago, we had an ad saying "Solid State Surplus proudly announces its first catalog." The point of the ad was that the ad itself is our catalog, although we didn't manage to make that point too clearly. . . I guess that's what happens when you let electronics freaks do the advertising.) There's another reason why we don't have a catalog: We'd have to charge more for our parts. When you send in your 65¢ for a regulator, you want to pay for the regulator, not the price of mailing catalogs out to other people. We are trying to avoid anything that would force higher prices. . .hence, no catalog. What's for sale is listed in the ad.

Another comment: we enjoy dealing with you, our friends and customers. We appreciate the notes, the comments and the criticisms, too. If you have something you feel like saying to us, go right ahead; we've all got big ears and we listen hard. The increased interest in the 4016, for example, is what put it in our repertoire of ICs. . .and who knows what we'll come up with in the months ahead?

But to return to the present, here's what we sell now. You know the rest; spiffy data sheets, orders filled (usually airmail) within 48 hours of receipt, no backordering, and individual testing of each part. . .just what the world needs, another surplus place.

SOLID STATE SURPLUS

LM 309K 5V 1A regulator $1.20
LM 311M high performance comparator $1.00
LM 339 dip quad comparator $1.50
LM 555 timer $.85
LM 723D adjustable precision voltage regulator $.65
LM 741 mini compensated op amp $.45
LM 747 dip dual 741 $.70
LM 3900 dip quad op amp $.45
LM 4250 TO5 programmable op amp $2.00
LM 1558 mini dip dual 741 $.75
NE 531 minidip hi slew op-amp $1.25
CD 4016 quad analog switch $1.00

ABOVE MATERIAL IS GUARANTEED FUNCTIONAL, RETESTED MATERIAL. USER SATISFACTION GUARANTEED FOR HOBBY AND EXPERIMENTAL APPLICATIONS.

SOLID STATE SURPLUS
BOX 255
MONTE RIO CA 95462

DuPage FM

WILL NOT BE UNDERSOLD!

NOVEMBER SALE OF THANKSGIVING SPECIALS

These goodies will last longer than the Thanksgiving turkey!

TWO METER PORTABLES

TEK Portable Mobile Transceiver. This 8 watt portable slides into a mounting rack and becomes a 25 watt mobile. The entire unit is transistorized. These units are less than two years old. Price includes Nicad battery, mobile mounting rack, mobile speaker, microphone.

All for $400.00

MOTOROLA H23AAC: 1½ watts output on two meters. This is the familiar "Lunchbox" which uses transistors in the receiver and instant heat tubes in the transmitter, with a dry battery supply. $30.00 each

MOTOROLA HT200 (H23DEN) features solid state receiver and transmitter. These units require some repairs and are not operable at this time. Only 4 left at $75.00 each

SIX METER PORTABLES

MOTOROLA HT200 (H21DCN) 1½ watts output. Solid state throughout. TWO FREQUENCY transmit and receive. These are presently tuned to 47.7 mc and will tune to 54 mc without further conversion. Most are with the carrying case. $150.00 each

BASE STATIONS:

MOTOROLA L41GGB: 30 watts output from these table top base stations. These units are presently tuned to 46.46 mc. $150.00 each

GENERAL ELECTRIC: Remote control units, Model number 4EC8, only $35.00 each

Supplies are limited, so don't delay, send your check today to;

DU PAGE FM INC. P.O. Box 1 Lombard, Ill. 60148
(312) 627-3540

TERMS: All items sold as is. If not as represented return for exchange or refund (our option) shipping charged prepaid within 5 days of receipt. Illinois residents must add 5% sales tax. Personal checks must clear before shipment. All items sent shipping charges collect unless otherwise agreed. Accessories do not include crystals, relay or antennas.

COMMUNICATIONS UNLIMITED

AT YOUR SERVICE

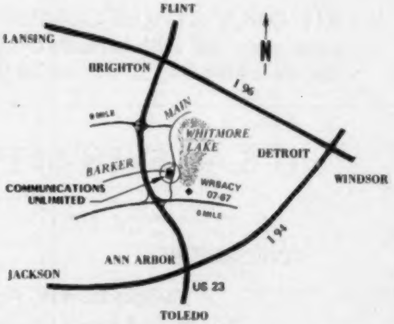
Henry
Jean
Betty
Ray
Lynn
Charlie
Gretchen
Sammy

SPECIALISTS IN CCTV, VTR's, FM COMMUNICATIONS.

Toledo
SB-23 – 9 mile exit
NB-23 – Barker Road exit – 1 block to Main Street

Store: 9519 Main
Whitmore Lake MI
Hours – Noon – 6pm Tue – Sat ES
Closed some Saturdays
313-449-4367

We sell M-Tech, Midland, Larson, A/S, Hitachi, Motorola, Dak, Ampex and many others


FLINT
LANSING
N
BRIGHTON
I 96
9 MILE
MAIN
WHITMORE LAKE
DETROIT
BARKER
WINDSOR
COMMUNICATIONS UNLIMITED
WB8ACY 07-67
8 MILE
I 94
ANN ARBOR
JACKSON
US 23
TOLEDO

WE SERVICE *Ampex, IVC, Sony, Panasonic, Shibaden, Norelco and others VTR's and CCTV Equipment*

We are an independent sales and service company. Our product loyalty is from experience not sales franchise. Qualified, unbiased.

Consultation service available for video systems large and small.

NEW!

HT-144B

TWO METER F.M. PORTABLE

See p. 16 for New Product Review

CRYSTAL SOCKETS INCLUDED!
IMPROVED TRANSMIT AUDIO!
UP TO 6 KC DEVIATION!
.35 uV SENSITIVITY OR BETTER!
.25 SQUELCH SENSITIVITY!
IMPROVED INSTRUCTION MANUAL!
F.C.C. TYPE APPROVAL PENDING!

KIT ONLY $129.95 COMPLETE less batteries AND for a limited time only we will furnish ONE SET OF CRYSTALS FREE! Your choice of 94-94; 52-52; or 34-94.

IT'S AN EVEN BETTER BUY NOW ! ! ! ! ! !

ACCESSORIES:

"Rubber Duckie" Antenna (BNC Connectors)	$12.95
Nicad Batterie Charger	$ 4.95
Sealed 12V Nicad Battery Pack	$29.95

Please include $1.00 for Shipping and Handling – N.Y.S. residents add sales tax

VHF ENGINEERING

– DIV. of BROWNIAN ELECTRONICS CORP. –
320 WATER ST. POB 1921 BINGHAMTON, NY 13902 607-723-9574

7-Segment Readout 12-PIN DIP

Three digits with right-hand decimal
Plugs into DIP sockets
Similar to (LITRONIX) DL337
Magnified digit approximately .1"
Cathode for each digit
Segments are parallel for multiple operation
5-10 MA per segment
EACH $3.00 4 (12 Digits) $11.00

RCA Numitron

EACH.............$ 5.00

SPECIAL: 5 FOR $20.00

DR2010

Potter & Brumfield

TYPE KHP RELAY
4 PDT 3A CONTACTS

24 VDC (650 coil)....$1.50

120 VAC (10.5 MA coil)....$1.75

Power Supply SPECIAL!

723 DIP variable regulator chip 1-40V, + or - output @ 150 MA 10A with external pass transistor--with diagrams for many applications.
EACH $1.00 10 FOR $8.95

SPECIAL

Special 741 fully-compensated operational amplifiers. 14-Pin DIP (only). Unmarked, tested, guaranteed. Super Special!
EACH $.35 10 FOR $3.00

5001 Calculator

40-Pin calculator chip will add, subtract, multiply, and divide. 12-digit display and calculate. Chain calculations. True credit balance sign output. Automatic over-flow indication. Fixed decimal point at 1, 2, 3, or 4. Leading zero suppression. Complete data supplied with chip.

CHIP AND DATA.........ONLY $6.95
DATA ONLY (Refundable)... $1.00
5002 LOW POWER CHIP AND DATA $12.95

High Quality PCB Mounting IC Sockets

8-PIN, 14-Pin, 16-Pin and 24-Pin PCB mounting ONLY--no wire wrap sockets.

8-Pin	$ .22
14-Pin	$ .26
16-Pin	$ .30
24-Pin	$ .75
40-Pin	$1.25

All IC's are new and fully-tested. Leads are plated with gold or solder. Orders for $5 or more will be shipped prepaid. Add 55¢ for handling and postage for smaller orders; residents of California add sales tax. IC orders are shipped within 2 workdays--kits are shipped within 10 days of receipt of order. $10 minimum on C.O.D.'s (phone in). (916) 334-2161

MAIL ORDERS:

P. O. Box 41727
Sacramento, CA
95841

4811 Myrtle Ave.
Sacramento, CA
95841

MONEY BACK GUARANTEE ON ALL GOODS!
SEND FOR FREE FLYER LISTING 100's OF MONEY-SAVING BARGAINS!

CTμL SPECIAL

Complementary Transistor Logic. This logic family is unique in that both NPN and PNP transistors are combined in the same package. Unlike TTL & DTL, the outputs are current sources (in the high state) as well as sinking current in the low state. These are brand new units, some of which are mismarked with DTL numbers.

CTL 9956 dual 2-input AND buffer
CTL 9953 2-2-3-input AND/OR gate
CTL 9952 dual 2-input NOR gate

Data supplied; all parts are dual-in-line. MIX OR MATCH. 5 FOR $1.00

LED's

MV50 Red Emitting 10-4 MA @ 2V	$ .20 10 FOR $1.25
MV5024 Red TO-18 High Dome	$ .35 10 FOR $2.95
MV108 Visible Red 5-7 MA @ 2V	$ .30 10 FOR $2.50

CMOS

CD4001	$ .75	CD4023	$ .75
CD4002	.75	74C20	.75
CD4011	.75	74C160	3.25
CD4012	.75		

3-Amp Power Silicon Rectifiers

MARKED EPOXY AXIAL PACKAGE

PRV	PRICE	PRV	PRICE
100	$.10	800	$.30
200	.15	1000	.40
400	.18	1200	.50
600	.23	1500	.65

DIODE ARRAY 10-1N914 silicon signal diodes in one package. 20 leads spaced .1"; no common connections.
EACH.....$.29
10 FOR $2.50

BABYLON ELECTRONICS

7400	$ .25	74H51	$ .35
74H00	.35	7453	.20
7401	.20	7454	.25
74H01	.35	74L54	.35
7402	.35	74L55	.35
7404	.28	7460	.20
74H04	.35	74L71	.30
7405	.28	7472	.40
7406	.70	74L72	.50
7408	.35	7473	.60
74H08	.35	74L73	.75
7410	.25	7474	.65
7413	1.25	74H74	.80
7417	.40	7475	1.40
7420	.25	7476	.60
74L20	.35	74L78	.80
74H20	.35	7480	.65
74H22	.35	7483	1.00
7430	.25	7489	4.00
74H30	.35	7490	1.20
74L30	.40	7492	.90
7440	.25	7493	1.15
74H40	.35	7495	1.15
7441	1.25	74L95	2.00
7442	1.20	74107	.70
7447	1.50	74145	1.20
7450	.25	74180	1.25
74H50	.35	74193	1.50
7451	.25	74195	1.00
74L51	.30		

7400 Series DIP

25K Trimmer

PRINTED CIRCUIT BOARD TYPE
EACH $.20 10 FOR $1.50

Rectifiers

VARO FULL-WAVE BRIDGES

V5447	2A	400V	$ .90
V5647	2A	600V	$1.10
MR810 Rectifier	1A	50V	$ .10

Special 811: Hex Inverter

TTL DIP Hex Inverter; pin interchangeable with SN 7404. Parts are brand new and branded Signetics and marked "811."

	EACH	$ .30
DATA	10 FOR	2.50
SHEET	100 FOR	23.00
SUPPLIED	1000 FOR	$220.00

MAN 3

0-9 plus letters. Right-hand decimal point. Flat-pack type case. Long operating life. IC voltage requirements. Ideal for pocket calculators!
EACH $1.25
10 OR MORE $1.00 EA

MAN 4

7-Segment, 0-9 plus letters. Right-hand decimal point. Snaps in 14-pin DIP socket or Molex. IC voltage requirements. Ideal for desk or pocket calculators!
EACH $2.75 10 OR MORE $2.50 EACH

CD-2 Counter Kit

This kit provides a highly sophisticated display section module for clocks, counters, or other numerical display needs. The unit is .8" wide and 4 3/8" long. A single 5-volt power source powers both the ICs and the display tube. It can attain typical count rates of up to 30 MHz and also has a lamp test, causing all 7 segments to light. Kit includes a 2-sided (with plated thru holes) fiberglass printed circuit board, a 7490, a 7475, a 7447, a DR2010 RCA Numitron display tube, complete instructions, and enough MOLEX pins for the ICs... NOTE: boards can be supplied in a single panel of up to 10 digits (with all interconnects); therefore, when ordering, please specify whether you want them in single panels or in one multiple digit board. Not specifying will result in shipping delay.

COMPLETE KIT ONLY $11.95
FULLY-ASSEMBLED UNIT $15.00

Boards supplied separately @ $2.50 per digit.

LINEARS

NE540	70-Watt power driver amp	$2.00
NE555	Precision timer	1.50
NE560	Phase lock loop DIP	3.25
NE561	Phase lock loop DIP	3.25
NE565	Phase lock loop TO-5	3.25
NE566	Function generator TO-5	4.00
NE567	Tone decoder TO-5	3.00
709	Popular Op Amp DIP	.45
710	Voltage comparator DIP	.75
711	Dual comparator DIP	.40
723	Precision voltage regulator DIP	1.00
741	Op amp TO-5/MINI DIP	.55
747	Dual 741 op amp DIP	1.50
748	Op Amp TO-5	1.00
CA3018	2 Isolated transistors and a Darlington-connected transistor pair	1.00
CA3026	Dual differential amp	1.00
CA3045	5 NPN transistor array	1.00
LM100	Positive DC regulator TO-5	1.00
LM105	Voltage regulator	1.25
LM302	Op Amp voltage follower TO-5	1.25
LM308	Op Amp TO-5	2.00
LM309H	5V 200 MA power supply TO-5	1.00
LM309K	5V 1A power supply module TO-3	2.00
LM311	Comparator TO-5	1.75
LM370	AGC amplifier	2.00
LM380	2-Watt Audio Amp	1.75
LM1595	4-Quadrant multiplier	2.00
MC1536T	Op Amp	2.00

CALCULATOR KIT

Kit contains NORTEC calculator chip 4024.21 driver transistors, 8 LED's, 7 segment readout by EXITON, 3 LED for overflow, low btry, overrange, a keyboard by FLEX KEY. All this $45 value for only $16.50 2 for $27

BASIC CLOCK KIT

We furnish clock chip CT7001 and 4 first line LED readouts .3 inch hgt. You furnish the misc. minor parts. A $35 value for $19.95

LIQUID CRYSTAL WATCH

Build a wrist watch or desk clock with this liquid crystal display. Recently written up in several magazines. Display with special socket reads hours and minutes $15 2 for $25

UNDERWATER LISTENING

Brand new by OLIN. Use it for a swim pool monitor-alarm, use it on lake or ocean listening to underwater noises, fish, etc. Complete with hydrophone, 50 ft. mike cable, speaker-amplifier console. Operates from 115 volts AC or 15 volt dry cells. 12 lbs. $25

CALCULATOR CHIPS

5001 LSI (40 pin) Add, subtract, multiply divide 12 digit. With data $6.95
Data alone 50 cents

CMOS 4814 HEX INVERTER

CMOS HEX INVERTER, dual inline package. 3-18 volt range, dual diode protection against static charge. Dielectrically isolated complimentary MOS. $1.00 each 12 for $10.00

DUAL 16 BIT MEMORY

Dual 16 bit memory, serial MOS by Philco TO-5 case, brand new with 2 page specs.
#PLR 532 $1.00 each $10/12

AM-FM RADIO $5.50

Due to the West Coast ship strike they came in too late for the customer. Now it's your bargain. Use it as is or build it into your own cabinet, desk, wall, etc. All built, ready to use with AC supply. To make it portable all you do is power it with a couple of "D" cells. Fully assembled solid state chassis with AC power supply, less speakers. Covers full AM as well as FM broadcast. The price an astounding meager $5.50

FLEX-KEY KEYBOARD FOR POCKET CALCULATORS $1.50

POWER AMP XFMR 380 WATT

115 volt input, 64 VCT 6 amp output

$11.95 each, 2/$22, 5/$50

COLUMBIA 4 CHANNEL SQ

Solid state SQ 4 channel adapter, 2 amps built in. Decodes 4 channel or synthesizes 4 channel. $35.00

LED READOUTS 5/$1.00!

The price is not a mistake. We have some hobby variety with some segments out. Ukinbuyem for as low as 5 for $1.00

PHOTO STROBE

For use with most Instamatic cameras. With nicad battery and built-in charger. Never buy flash cubes again. $9.95

AM–FM RADIO

For console installation, w/face plate, no knobs. Stereo amplifiers for tape or turnable playback. $15.00
Pair of matching speakers w/xfmrs for above $5.00

CALCULATOR CHASSIS

Fully assembled pocket calculator chassis with calculator chip. Uses LED readouts not included. $5.00

ELECTRIC SIREN $10.00

Brand new, operate 6 or 12 volts dc. Just the thing to protect car or boat. Used also as burglar or fire alarm in house & camp. Kinda scarce, but we found some. While they last
$12 each, 2/$20.00

SOLAR ENERGY

Electricity for free from the sun. An exciting experimental device. Instructions included show how to make a solar energy bank for higher voltages and/or current, also how to make a solar operated radio receiver.

Giant cell 2" diameter – $1.50
Large cell 1 3/4" – $1.25
Medium cell 1" diameter – $1.00
Rectangular 3/4 x 1½" – $.75
Any six for the price of 5 . . .

BOOKSHELF SPEAKERS

Completely finished, 9 x 12 x 5 inches. 16 ohm, with extension cord. **$15 a pair.**

Meshna

Postage extra on above. **MESHNA PO Bx 62 E. Lynn Mass. 01904**
96-page catalog FREE!

RGS ELECTRONICS

008A MICROCOMPUTER KIT
8008 CPU, 1024 x 8 memory; memory is expandable. Kit includes manual with schematic, programming instructions and suggestions; all ICs and parts supplied except cabinet, fuses & hardware. Includes p.c. boards. $375.00
MANUAL ONLY, $25.00

008A-K ASCII KEYBOARD INPUT KIT
Includes keys, p.c. board, all ICs, power supply, instructions, schematic. Intended to interface ONLY with the RGS Electronics 008A Microcomputer. $50.00

SPECIAL – THIS MONTH ONLY!
LM1800 PLL stereo demultiplexers. No coils!!
Regularly $2.50; THIS MONTH, $2.00 ea.

"THE CUBE" Fully assembled subaudible tone generator for small handheld or portable FM radios. 9-16 volts; no moving parts; set anywhere between 98 & 240 Hz with a trim resistor.
.5" x .6" x .7" $19.95
Set on frequency by the factory, $5.00 extra

TTL

7400	$ .20	7485	$1.40
7401	.20	7486	.50
7402	.20	7489	2.90
7403	.20	7490	.80
7404	.25	7492	.80
7405	.25	7493	.80
7406	.45	7495	.90
7407	.45	7496	.85
7408	.25	74107	.50
7409	.25	74121	.60
7410	.20	74122	.60
7411	.30	74123	1.10
7413	.85	74125	.65
7416	.45	74126	.65
7417	.45	74141	1.25
7420	.20	74150	1.70
7430	.20	74151	1.00
7432	.30	74153	1.40
7437	.50	74154	1.70
7438	.50	74157	1.40
7440	.20	74161	1.50
7442	1.10	74163	1.70
7446	1.45	74164	2.00
7447	1.45	74165	2.00
7448	1.45	74166	1.75
7450	.20	74174	2.20
7451	.20	74175	2.20
7453	.20	74176	1.60
7454	.20	74177	1.35
7473	.45	74181	3.90
7474	.45	74192	1.50
7475	.80	74193	1.45
7476	.50	74195	1.00
7483	1.10	74200	8.00

PS 25–1 0 to 25v 1a lab type power supply with adjustable current limiting; remote sensing & remote programming for voltage & current. Instructions included. All parts except chassis & meter(s).
Kit of parts with schematics $14.95
P.C. boards available, No. 007, $3.00 ea

PS 5–1 5v 1a regulated power supply kit with p.c. board & instructions. Board measured 2" x 6"; completed kit is 2" high. Transformer has internal r.f. shield. $8.00

TRANSISTORS	1 - 9	10+
NPN TO–18 general purpose silicon	$ .15	$ .10
PNP TO–18 general purpose silicon	.15	.10
2N2222 (NPN) TO–18	.25	.20
2N2907 (PNP) TO–18	.25	.20

TO–92 general purpose NPN & PNP transistors, beta > 100, breakdown > 40v $ .08 each $5.95/100

JUNCTION FETs, TO–18 case

N–CHANNEL:	SIMILAR TO:	
NJF10	2N4416, MPF102	3/$1.00
NJF11	2N4091–93	4/$1.00
NJF12	2N4338–41	4/$1.00
NJF13	2N3089	3/$1.00
NJF14	2N4221–22	4/$1.00
P–CHANNEL:		
PJF11	2N3382–86	4/$1.00
PJF14	2N2608	4/$1.00

All FETs come with data sheets.

RGS ELECTRONICS

3650 Charles St., Suite K • Santa Clara, CA 95050 • (408) 247–0158

We sell many ICs and components not listed in this ad. Send a stamp for our free flyer. TERMS OF SALE: All orders prepaid; we pay postage. $1.00 handling charge on orders under $10.00. California residents please include sales tax. Please include name, address and zip code on all orders and flyer requests.

DISCOUNTS: 10% OFF ORDERS OVER $25.00; 20% OFF ORDERS OVER $250.00.

CHARGE IT
ON

master charge
THE INTERBANK CARD

CHARGE IT
ON

Your
BANKAMERICARD
welcome here

DIAL-A-DEAL

TOLL
FREE
NUMBER
(Continental 48 States)

**800
325-3636**

**MO CUSTOMERS CALL
314-993-6060
COLLECT**

HAM RADIO CENTER

**CALL
FREE**

**CALL
FREE**

**TRADE
ON
NEW**

CALL

**TRADE
ON
USED**

HAM RADIO CENTER
(9 A.M.—5 P.M. Central, Closed Sun. & Mon.)

FOR
A SQUARE DEAL
ON

- **DRAKE**
- **TEMPO/ONE**
- **TEN-TEC**
- **CLEGG**
- **STANDARD**
- **YAESU**
- **SWAN**
- **COLLINS**
- **KENWOOD**
- **REGENCY**

*We carry all major brands and a large
stock of used reconditioned equipment*

HAM RADIO CENTER INC.
8342 OLIVE BL. ST. LOUIS, MO 63132

IF YOU CAN SOLDER, YOU CAN BUILD YOUR OWN

Clock/Calendar

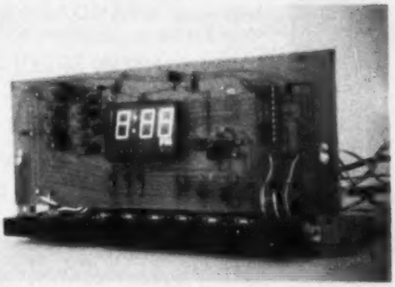
SOLID STATE SYSTEMS, INC. has available a CLOCK/CALENDAR kit containing over 120 separate electrical components.

The clear, simplified instructions include step by step construction procedures and ample illustrations which will quickly take you through construction of this versatile Clock/Calendar.

THE KIT FEATURES:

- ★ **DISPLAY OF DATE WITH MONTH AND DAY** - displays month and day automatically, through year, except for February 29.
- ★ **DISPLAY OF TIME ON 12 HOUR CYCLE** - hours and minutes displayed with A.M. and P.M. indicators.
- ★ **A 24 HOUR ALARM OPTION** - this also includes a snooze button which delays alarm an additional 10 minutes.
- ★ **A 9 HOUR 59 MINUTE TIMING OPTION** - this allows operation of any pluggable 600 watt, 120 volt, 5 amp, 60 Hz electrical device such as a radio, room light, stereo or coffee pot.
- ★ **EASILY VISIBLE SPERRY® DISPLAY** - this display is highly visible in a well lighted room.

An attractive case may be fabricated of wood, plexiglas, metal or whatever you feel would make an appropriate show-case for your finished kit.



PLEASE NOTE: These kits do not include cases.

This kit when completed is a sophisticated device which offers many additional features due to its flexibility, here are two examples of what can be done with this device:

1. You may set the timer to play your radio for 15 minutes at bedtime, then the alarm allows you the option of waking up to the radio in the morning all automatically.
2. You may set the alarm to later start an appliance which will operate for the duration of the setting on the timer.

TO ORDER:

Order Number **01-12241 - BASIC CLOCK** - This kit does not include the 24 hour alarm option or the 9 hour 59 minute appliance timer option. Price . . . . $49.95.

Order Number **02-12241 - COMPLETE CLOCK**, This kit includes all available options. Price . . . .$65.00.

SOLID STATE SYSTEMS, INC.

SEND YOUR ORDERS TO:
SOLID STATE SYTEMS, INC.
P. O. BOX 617
COLUMBIA, MISSOURI 65201

OR PHONE (TOLL FREE)
800-325-2981 – 800-325-2983

2 METER FM HEADQUARTERS

NEW extended hours convenient location at ERICKSON COMMUNICATIONS

only STANDARD

sells more STANDARDS than Erickson....and here's why

ERICKSON SPECIAL !
SRC-146A with

- *Charger*
- *"Stubby" antenna*
- *Leather case*
- *Ni-Cads*
- *94/94, 34/94 and one channel of your choice*

List Price:	$369.00
YOU SAVE:	50.00
YOUR PRICE: only	$319.00

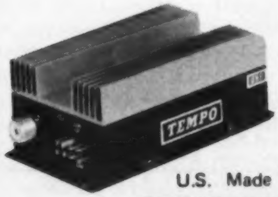
Shipped prepaid for cashier's check or M.O.

SYNTHESIZED !

Inoue's New
IC-230

- 162+ channels, simplex or offset (600 kHz) for repeaters
- All modular construction
- Super hot MOSFET/helical coil .4μV receiver
- AVAILABLE NOW ! . . . only **$489.00**

TEMPO SOLID-STATE POWER AMPS



U.S. Made

MODEL	DRIVE POWER	OUTPUT POWER	PRICE
1202	5-25 watts	100-135 watts	$228
1202B	1-2.5 watts	120-130 watts	$239
802	5-12 watts	70-90 watts	$190
802B	1-2.5 watts	80-90 watts	$195
502	5-15 watts	35-55 watts	$110
502B	1-2.5 watts	45-50 watts	$130
302	1-2.5 watts	30-35 watts	$93
152	1 watt	15 watts	$59

And many more from SBE/Clegg/ICOM/Kenwood/Tempo/Antenna Specialists/Larsen

Make ERICKSON your headquarters for all your FM needs . .

SEND QSL FOR COMPLETE SPECIFICATIONS

ERICKSON COMMUNICATIONS

4135 Main Street Skokie, IL 60076 (312) 677-2161
Extended hours: Days 9 – 4:30, Monday through Saturday;
Evenings 6:30 – 9, Monday, Thursday, Friday

GODBOUT

BILL GODBOUT ELECTRONICS
BOX 2673, OAKLAND AIRPORT, CA 94614

THOSE WHO HAVE BOUGHT THE 8008 PROCESSOR FROM US OR RGS OR CYBERTRONICS WHO ARE INTERESTED IN SHARING HARDWARD AND SOFTWARE PLEASE SEND FULL NAME AND ADDRESS – AND WE WILL PREPARE A MAILING LIST AND SEND IT TO ALL WHO HAVE SENT IN NAMES AND ADDRESSES.

8008 PROCESSOR 8 bit on a chip **$50.00**

21G2102/2602 N CHAN Bit static RAM.
SPECIAL FOR THIS MONTH ONLY $15.00

TTL SPECIAL 74175 Quad Latch	**$1.10**
MOS DYNAMIC MEMORY 1 x 1024 bit MM5260	**$5.00**
LINEAR SPECIAL 741 Mini Dip op amp	**10/$3.50**
LM 309K 5V 1A REG	**$1.75**
LM 320K NEG Reg available in 5V 12V & 15V	**$2.25**
LM 340K POS Reg available in 6V, 8V, 12V, 15V, 24V	**$2.25**
4194 TK adjustable dual tracking reg TO66	**$3.90**
4195 TK dual tracking reg ±15V TO66	**$3.40**

ICs, most TTL & LINEAR in stock – Send stamp for FREE catalog

CMOS DIGITAL

74C00	.60	CD4011	.55	CD4042	2.95	555	.85
74C02	.60	CD4012	.55	CD4044	2.95	556	1.60
74C04	.85	CD4013	1.10	CD4049	1.10	723T	.95
74C10	.60	CD4014	4.00	CD4050	1.10	723D	.75
74C20	.60	CD4015	4.00	CD4116	1.25	741M	.45
74C73	1.65	CD4016	1.10	LINEAR		741T	.50
74C74	1.25	CD4017	3.20	LM301M	.45	747D	.75
74C76	1.75	CD4018	3.25	LM311M	.95	748M	.50
74C107	1.75	CD4019	1.25	LM318	1.75	1595	1.50
74C151	3.30	CD4020	3.50	LM339	1.50	1596	1.75
74C160	3.25	CD4021	4.00	LM370	1.25	CA3028	.75
74C161	3.25	CD4023	.55	LM371	1.25	CA3065	.75
74C162	3.25	CD4024	2.75	LM372	1.25	CA3086	.45
74C163	3.25	CD4025	.55	LM374	2.00	3900	.65
74C195	3.15	CD4027	1.50	LM380	1.65	4136	1.95
CD4001	.55	CD4029	6.00	LM381	1.75	4250T	2.25
CD4002	.55	CD4030	.55	LM382	1.75	5556M	1.50
CD4008	4.00	CD4035	2.50	LM399	1.75	5558	.75
CD4009	.75	CD4037	2.95				
CD4010	.75	CD4040	5.00				

ALL ITEMS IN STOCK and will be shipped within 24 working hours of receipt of order!

Include 50¢ postage and handling on orders under $10.00

Sorry, NO C.O.D.'s. CALIFORNIA RESIDENTS ADD sales tax.

JUGE

MOTOROLA 2m FM

- 25 or 10 watt models with 1-watt low power switch
- Installation of receive frequency crystal provides receive, simplex transmit and repeater transmit (−600 kHz)
- Best intermod and adjacent channel refection available
- 12-channel capability
- Optional tone burst encoder — mounts internally
- Optional secondary transmit offset frequency kit
- Snap-in mounting tray
- Typical Motorola quality and performance

SPECIAL

25 watt model

$349.95

FOR A LIMITED TIME . . .
(financing available)

xtals $9 ea.

ED JUGE ELECTRONICS, INC.

3850 S. FREEWAY
FT. WORTH TX 76110

11181 HARRY HINES BLVD.
DALLAS TX 75229

THREE QUARTER INCH DIGITS BY OPCOA

3 for $13.

- 0.7 character
- 0 to 9
- 7 Segments 30 mils

Any color **$4.95** RED — GREEN YELLOW

Order by type number

	Type	Color
☐	SLA-3H	RED
☐	SLA-4H*	RED
☐	SLA-13	GREEN
☐	SLA-14*	GREEN
☐	SLA-23	YELLOW
☐	SLA-24*	YELLOW

*Plus or Minus one

OPCOA SLA-1 REFLECTIVE LED READOUT
"Red" ☐ **$1.95** 3 for $5
7-segment. Character 0.33"

☐ **5.95**
8 WATT STEREO AUDIO AMP

The factory "snipped" most of the cables to this compact 8 watt stereo unit with aluminum escutcheon plate. It's easy to use because we have all the cables marked ready to use. With power supply. 115vac. 3 controls, LEFT and RIGHT VOLUME controls for two speakers for balancing and center TONE control. With knobs. 7 x 3½ x 3½. Hookup spec sheets.

PROFESSIONAL 8-TRACK TAPE TRANSPORT

Same type unit found in the most expensive home tape players. It's a complete 8-track player system with BUILT-IN PREAMP — just plug into any stereo amplifier (see some of our low-priced units). Excellent replacement unit, or you can design your own high-quality stereo tape system. It's the type you insert a cartridge to turn-on deck, then enjoy up to 80 minutes of non-stop, non-repeat stereo. Remove cartridge and player "shuts off" automatically. Built-in output controls in preamp. Features: 4 PROGRAM INDICATOR LIGHTS, automatic or manual program change, plays your car tapes at home. WOW-FREE precision fan-cooled motor, which operates off 115Vac. Requires external 12Vdc supply, for the electronics. With diagrams.

☐ **$15.95**

8-Watt Stereo Amplifier, 8-Track Tape Transport and hook-ups both. ☐ Only **$19.95**

Money-Back GUARANTEE on all items

Calculator 6-8-12 DIGIT Basics

☐ Your Choice **$16.95**

BASIC KIT #1 — includes case, all-function Flex Key Keyboard, Cal Tech CT5002 calculator chip, 9-digit Antex LED display with built-on individual magnifiers, plus sheets.

BASIC KIT #2 — same as Basic #1 except calculator chip is National 8-digit MM5725.

BASIC KIT #3 — same as Basic #1 except calculator chip is National 6-digit MM5736 and 75492.

12 DIGIT BASIC #4 — Key parts include: CT5001 chip, 4-3 digit readouts, factory etched PC board, case, carrying case, 2-resistor networks, decimal switch. Wild Rover Keyboard with ON-OFF switch diagrams. **Sale $24.95**

12* DIGIT BASIC "MEMORY" KIT #5 — Key parts for 4-memory calculator. Case with "slight touch keyboard", CT5005 memory chip, 6 MAN 3's, ON-OFF switch, book, (*extend key allows 12 digits), pc boards). **$19.95**

EPOXY FULL WAVE SILICON BRIDGE RECTIFIERS

PIV	2 Amp	6 Amp
50	☐ $.69	☐ $.88
100	☐ .79	☐ .99
200	☐ .95	☐ 1.25
400	☐ 1.19	☐ 1.50
600	☐ 1.35	☐ 1.75
800	☐ 1.59	☐ 1.95
1000	☐ 1.79	☐ 2.25

Code: 2 amp is TO-5 case
6 Amp ½ x ½ x 3/16 sq

"ULTRA BRITE" XCITRON LEDS
$2.50 ☐ 9-pc. kit
One of Poly Paks exclusive ultra-brite offers at "dull" prices. Kit includes: 3 REDS, 3 GREENS, 3 YELLOWS, each including JUMBOS, MEDIUM and MICROS.

CLOCK CHIPS ON A "DIP" as Low as **$4.95**

- ☐ MM5311 6-digit 28-Pin $7.77
- ☐ MM5312 4-digit 24-Pin 7.77
- ☐ MM5313 6-digit 28-Pin 7.77
- ☐ MM5314 6-digit 24-Pin 7.77
- ☐ MM5316 4-digit 40-Pin, Alarm 9.95
- ☐ MM5316A-minus Alarm 4.95

WITH DATA SHEETS

INTEGRATED CIRCUIT SOCKETS

Buy Any 3 Take 10% Discount!

- ☐ 14-Pin, DIP . . . . $.45
- ☐ 14-Pin, Side Mount 1.00
- ☐ 16-Pin, DIP 50
- ☐ TO-5, 8 or 10-Pins . .29
- ☐ 8-Pins (Mini DIP) . .39
- ☐ 14-Pin, Wire Wrap . . . 69c
- ☐ 16-Pin, Wire Wrap . . . 89c

SANKEN HYBRID AUDIO POWER AMPS

	Mfgr's Type	Watts	Sale
☐	SI-1010Y	10	$ 8.88
☐	SI-1025E	25	18.88
☐	SI-1050E	50	29.95

Used extensively in hi-fi systems, tape decks, FM tuners, record players, stereo components, musical instruments, P.A., etc. All amplifiers, flat within ½ db from hz to 100,000. Each unit properly heat-sinked, with heavy-duty connecting tie lug connections. Single-ended pushpull output. Power supply required 24VDC. Output to 8 ohms. Order by Stock No.

HIGH POWER TRANSISTOR WITH HEAT SINK

3 for $3 ☐ **$1.49**
Removed from new equipment! Includes popular 2N174 'doorknob' transistor TO-36, germanium, PNP, 150 watts, VCBO 80V, 15 amps, 40 hfe. For ignition, high power transmitters, etc. Mounted on heat sink 5 x 2½ x 1¼"

6 DIGIT KRONOS CLOCK
6-digits
Using MAN-3 S
Complete **$29.95** ☐ KIT
Money-Back GUARANTEE on all items

PRECISION CRYSTAL ☐ Only **$1.95**
Excellent time base and other uses. 5.000 MHz. Type H6U case.

Inflation-Fighting ECONOMY IC PRICES

Buy 10 or more 15% discount
Buy 100 — Take 25%

Order by type number! Spec sheets on request "ONLY" • Factory Marked

Type	Sale	Type	Sale	Type	Sale	Type	Sale	Type	Sale
☐ SN7400	$.19	☐ SN7430	.24	☐ SN7472	.42	☐ SN74107	.49	☐ SN74161	1.59
☐ SN7401	.22	☐ SN7432	.28	☐ SN7473	.52	☐ SN74108	.95	☐ SN74163	1.75
☐ SN7402	.24	☐ SN7437	.45	☐ SN7474	.39	☐ SN74112	.95	☐ SN74164	2.85
☐ SN7403	.22	☐ SN7438	.49	☐ SN7475	.91	☐ SN74113	.95	☐ SN74165	2.85
☐ SN7404	.27	☐ SN7440	.22	☐ SN7476	.32	☐ SN74114	.95	☐ SN74166	1.85
☐ SN7405	.24	☐ SN7441	1.19	☐ SN7478	.70	☐ SN74121	.49	☐ SN74173	1.85
☐ SN7406	.79	☐ SN7442	1.02	☐ SN7480	.59	☐ SN74122	.55	☐ SN74174	2.25
☐ SN7407	.48	☐ SN7443	1.02	☐ SN7481	1.25	☐ SN74123	1.09	☐ SN74175	1.00
☐ SN7408	.27	☐ SN7444	1.02	☐ SN7482	.99	☐ SN74125	.65	☐ SN74176	1.25
☐ SN7409	.27	☐ SN7445	1.09	☐ SN7483	1.19	☐ SN74126	.89	☐ SN74177	1.25
☐ SN7410	.22	☐ SN7446	1.19	☐ SN7485	2.50	☐ SN74139	1.25	☐ SN74180	1.10
☐ SN7411	.31	☐ SN7447	1.19	☐ SN7486	.49	☐ SN74140	2.50	☐ SN74181	3.95
☐ SN7412	.55	☐ SN7448	1.19	☐ SN7489	3.19	☐ SN74141	1.19	☐ SN74182	1.05
☐ SN7413	.89	☐ SN7450	.27	☐ SN7490	1.19	☐ SN74145	1.19	☐ SN74185	2.34
☐ SN7414	2.25	☐ SN7451	.28	☐ SN7491	1.35	☐ SN74148	2.95	☐ SN74187	2.34
☐ SN7415	.48	☐ SN7453	.28	☐ SN7492	.99	☐ SN74150	1.19	☐ SN74192	1.59
☐ SN7416	.45	☐ SN7454	.39	☐ SN7493	.99	☐ SN74151	.99	☐ SN74193	1.59
☐ SN7417	.50	☐ SN7455	.28	☐ SN7494	1.05	☐ SN74153	1.39	☐ SN74194	1.89
☐ SN7420	.22	☐ SN7460	.26	☐ SN7495	.99	☐ SN74154	1.69	☐ SN74195	1.10
☐ SN7421	.50	☐ SN7461	.26	☐ SN7496	.99	☐ SN74155	1.29	☐ SN74196	1.20
☐ SN7422	.29	☐ SN7462	.39	☐ SN74100	1.55	☐ SN74156	1.45	☐ SN74197	1.10
☐ SN7423	.32	☐ SN7464	.39	☐ SN74104	1.25	☐ SN74157	1.45	☐ SN74198	2.45
☐ SN7425	.35	☐ SN7465	.39	☐ SN74105	.95	☐ SN74158	1.45	☐ SN74199	2.45
☐ SN7426	.31	☐ SN7470	.49	☐ SN74106	.95	☐ SN74160	1.85	☐ SN74200	9.95
☐ SN7427	.35	☐ SN7471	.55						

☐ **$9.99**
JUMBO 0.6" MITY DIGIT DCM

NEVER BEFORE OFFERED! Digital counting module kit using the big "M" Monsanto MAN-6 "ALL LED" readout. Same electrical specs as the MAN-1. Measures 1 x ⅞ x ⅛" encapsulated in red epoxy lens. Outperforms all reflective bar types. MORE BRILLIANT! Made for distance and wide-angle viewing. Fits into standard 14 pin DIP socket. Kit includes MAN-6, right angle IC socket, edge connector, pc board, assorted resistors and capacitors, SN7475, SN7447, SN7490, Molex sockets and booklet.

☐ Same as above except uses MAN-64, 0.4 ALL LED readout. MAN-1 characteristics . . . . .Only $8.88

"C" THRU S METER ☐ **$2.50**
Indicates: 0 to 1.5
Plastic case.
1½ x 1½ x 1".

SCRS! TRIACS! QUADRACS! SAME PRICE SALE!
10-Amp Power Tab Plastic Units

	PRV	Sale
☐	50	$ .75
☐	100	.95
☐	200	1.25
☐	300	1.50
☐	400	1.95
☐	500	2.25
☐	600	2.50

CRYSTAL OSCILLATOR **$4.95** ☐

Rare buy of these popular precision modules that are used by hams, clock enthusiasts, hobbyists. By Monitor, Type 850. Freq: 4.000 MHz. Accuracy to .001. Requires 5VDC. Generates a square wave on output. Size: 1¼ x 1 x ½".

Terms: add postage Rated: net 30
Phone Orders: Wakefield, Mass. (617) 245-3829
Retail: 16-18 Del Carmine St., Wakefield, Mass.
(off Water Street) C.O.D.'S MAY BE PHONED

☐ 20c CATALOG Fiber Optics, 'ICs', Semi's, Parts
MINIMUM ORDER — $4.00

POLY PAKS

P.O. BOX 942A LYNNFIELD, MASS. 01940

READER SERVICE

Check appropriate boxes for desired company brochures, data sheets or catalogs and mail in to 73. Include your zip code, please. Send money directly to advertisers.

LIMIT: 25 requests.

ADVERTISER INDEX

☐ Adirondack 77
☐ ADVA 101
☐ Airwaves Elec 133
☐ American Basic Corp 137
☐ Aptron 31
✳ ATV 145
☐ Audio Land 35
☐ Autek 133
☐ Babylon 157
☐ Cassette HQ 143
☐ CFP 96
☐ Clegg 51
☐ Columbia 127
☐ Comm Spec 123
☐ Comm Unltd 155
☐ Control Signal 123
☐ Cornell 145
☐ Curtis Electro Devices 66
☐ Data Eng 21, 72
☐ Datak 126
☐ Dupage 154
☐ Dynamic Elec 145
☐ ECM 145
☐ Egbert 128
☐ Emergency Beacon 18, 19
☐ Erickson 162
☐ Fair 145
☐ Freck 96
☐ Gateway 99
☐ GENAVE 24, 25
☐ Godbout 163
☐ Greene 123
☐ Hal 79
☐ Ham Radio Center 160
☐ Heath Insert
☐ Henry 7
☐ Icom 85
☐ Int. Elec Unltd. 150
☐ Int. Telecomm 39
☐ James Elec 151
☐ Jan 135
☐ Juge 164
☐ K A Sales 152
☐ K-Enterprises 86
☐ KLM 43
☐ Meshna 158
☐ MITS 149
☐ Morgain 96
☐ Nasem 96
☐ Newtronics CII
☐ Palomar 86
☐ Poly Paks 165
☐ Radio Amateur Callbook 106
☐ Regency 56, 57, 62, 63
☐ RGS Elec 159
☐ R & L Elec 133
☐ Rohn 47
☐ Sentry 11
☐ Solid State Surplus 153
☐ Solid State Systems 161
☐ Space Elec 145
☐ Spec Comm CIII
☐ SST 145
☐ A F Stahler 145
☐ Standard 111
☐ Sumner 65
☐ TPL 33
☐ Tri Tek 127
☐ Trumbull 145
☐ Tucker 118, 119, 120, 121, 122
☐ VHF Eng 156
☐ Weirnu 59
☐ Wilson 22, 23
☐ World QSL 145
☐ Yaesu C IV

73 STUFF

Hotline 83
QSL 87
73 Cassette Code Course 91
73 Rep Ad 103
73 Subscription Ad 107
73 Back Issues 115
Club Offer 137
Novice Tapes 123
Rep. Atlas 123
Vox Poop 128
Novice Guide 135
Books 146, 147, 148

☐ *NEWSSTAND* ☐ *SUBSCRIPTION*

***Reader service inquiries not solicited. Correspond directly to company.**

NOVEMBER 1974

Reader's Service
73 Inc., Peterborough NH 03458
Please Print or Type

Name____________________ Call________

Address______________________________

City ____________ State_____ Zip_______

Coupon expires in 60 days . . . . .

PROPAGATION CHART

J.H. Nelson

Good (open) Fair (☐) Poor (O)

November - 1974

Sun	*Mon*	*Tue*	*Wed*	*Thu*	*Fri*	*Sat*
					1	2
3	4	$\boxed{5}$	⑥	⑦	$\boxed{8}$	$\boxed{9}$
$\boxed{10}$	$\boxed{11}$	$\boxed{12}$	$\boxed{13}$	14	15	16
$\boxed{17}$	$\boxed{18}$	19	20	21	22	$\boxed{23}$
$\boxed{24}$	$\boxed{25}$	26	27	28	$\boxed{29}$	$\boxed{30}$

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	7A	7	7	3	3	3	3	3A	7	14	14	14
ARGENTINA	7	7	7	7	7	7	14	21	21	21	21	14A
AUSTRALIA	14	7B	7B	7B	7B	7B	7B	14	14	14	14	14A
CANAL ZONE	7	7	7	7	7	7	14	21	21	21	21	14
ENGLAND	7	7	7	3	7	7B	14	14A	14A	14	7B	7
HAWAII	14	7B	7	7	7	7	7	7B	7A	21	21	21
INDIA	7	7	7B	7B	7B	7B	14	14	7B	7B	7	7
JAPAN	7A	7B	7B	7B	7	7	3	7	7B	7B	7B	14
MEXICO	7A	7	7	7	7	7	7	14	21	14A	14A	14
PHILIPPINES	7A	7B	7B	7B	7B	7B	7	7	7	7B	7B	7A
PUERTO RICO	7	7	7	7	7	3A	14	14	14A	14A	14	14
SOUTH AFRICA	7	7	7	7	7B	7A	14	21	21A	21	14	14
U. S. S. R.	7	7	3	3	7	7B	14	14	14	7B	7B	7
WEST COAST	14	7	7	7	7	7	7	14	14	21	21	14A

CENTRAL UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3A	7	14	14A	14
ARGENTINA	14	7	7	7	7	7	7A	21	21	21	21	21
AUSTRALIA	14A	14	7B	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	7	7	7	7	7	7A	21	21	21	21	21
ENGLAND	7	7	7	3	7	7	7B	14	14	14	7B	7B
HAWAII	14A	14	7	7	7	7	7	7	7A	21	21	21
INDIA	7	7	7B	3B	7B	7B	3B	7A	7A	7B	7B	7B
JAPAN	14	7B	7B	7	7	7	3	7	7	7B	7B	14
MEXICO	7	7	7	7	7	3	3	7A	14	14	14	14
PHILIPPINES	14	7B	7B	3B	3B	7B	3A	7	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7A	14A	21	21	14A	14
SOUTH AFRICA	14	7	7	7	7B	7B	14	21	21A	21	14	14
U. S. S. R.	7	7	3	3	7	7	7B	14	7A	7B	7B	7

WESTERN UNITED STATES TO:

ALASKA	14	7A	7	3	3	3	3	3	7	14	14	14
ARGENTINA	14	14	7B	7	7	7	7B	14	21	21	21	21
AUSTRALIA	14A	14A	14	7B	7B	7B	7	7	14	14	14	21
CANAL ZONE	14	7	7	7	7	7	7	14	21	21	21	21
ENGLAND	7B	7	7	3	7	7	7B	7B	14	14	7B	7B
HAWAII	21	14	7A	7	7	7	7	7	7A	21	21	21
INDIA	7	14	7B	3B	3B	7B	3B	7	7	7	7	7B
JAPAN	14A	14	7B	7B	7	7	7	3	7	7	7B	14
MEXICO	14	7A	7	7	7	7	7	7A	21	14A	14A	14
PHILIPPINES	14A	14	7B	7B	7B	7B	7B	3A	7	7	7B	14
PUERTO RICO	14	7	7	7	7	7	7	14	21	21	21	14
SOUTH AFRICA	14	7	7	7	7B	7B	7B	7A	21	21	14	14
U. S. S. R.	7	7	7	3	3	3A	3	7A	7A	7B	7B	7B
EAST COAST	14	7	7	7	7	7	7	14	14	21	21	14A

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

new !

VERSATILE,
STATE OF THE ART
PERFORMANCE AT A
REASONABLE PRICE.
THE "EXPANDABLE" 2 METER FM
5 WATT TRANSCEIVER.

ENGINEERING BREAKTHROUGH!

SPEC COMM KNOCKS THE WIND OUT OF INFLATION

OPTIONAL ACCESSORIES COMING SOON

- ☐ *"Clip-on" rechargable battery module, w/carrying strap & 18" antenna.*
- ☐ *"Clip-on" 25 watt amplifier /lo noise receiver preamp module.*
- ☐ *"Clip-on" A.C. Power supply module.*
- ☐ *Modification kit to expand radio to 12 channels*
- ☐ *Companion Synthesizer*

MADE IN USA – 90 DAY WARRANTY
Fully wired & tested – not a kit.

LOW INTRODUCTORY PRICE!

$139.95 On orders postmarked on or before Nov. 15, 1974. After this date, the price is **$149.95**

NOW THERE'S NO EXCUSE FOR NOT JOINING THE FUN ON 2 METERS

Engineered to provide the best possible performance at the lowest possible price, the **SpecComm 560** opens the world of 2 Meter FM to everyone.

Integrated circuitry is used to the greatest possible extent for top performance and reliability, along with other 'State of the Art' circuit techniques which are now practical at low cost. The receiver features a **very wide dynamic range** front end which provides excellent intermod and overload performance. This is followed by a **six pole** monolithic crystal filter for superior adjacent channel rejection. (Many more expensive radios use a less selective four pole filter).

The transmitter features a **low distortion phase modulator** combined with excellent speech processing for beautiful sounding audio with 'plenty of punch.' The final stage uses a fully VSWR protected transistor, thus eliminating the nuisance and expense of critical shutdown circuitry.

A complete complement of accessories will be available so that the unit may be operated **over the shoulder, mobile** or **fixed.** Compact, **clip-on** modules are an integral part of the radio – not an afterthought! Another Plus – the **SpecComm 560** uses **commonly available**, low cost, TR22 type **crystals.**

Order your SPEC COMM 560 today . . . direct from the factory at the low introductory price of $139.95 (til 11/15/74) w/1 set xtals (.52 simplex).

Mobile Mounting Bracket	$6.95
Include Postage and Handling	$2.00
(PA residents add 6% tax)	

☐ **Sensitivity**	**0.6μV (typ.) 20dB quieting**
☐ **Bandwidth**	**±7.5 kHz @ -6dB** **±20 kHz @ -60dB**
☐ **Front End**	**FET w/Wide Dynamic Range Mixer for very low I.M.**
☐ **I.F.**	**10.7 MHz, single conversion**
☐ **Squelch**	**Fast attack; noise operated**
☐ **Audio Output** . .	**2 wts (max)**
☐ **RF Output**	**5 wts (nom) @ 13.5 VDC**
☐ **Modulation**	**Low distortion Phase Modulator, w/ up to 12dB of Speech Clipping**
☐ **Deviation**	**Adjustable; factory set to ±5 kHz**
☐ **Final Stage**	**Fully VSWR protected. No shutdown required**
☐ **Microphone**	**Hi Z Ceramic, (Turner)**

- ☐ **Frequency Range . . . 146 to 148 MHz**
- ☐ **6 Channels w/trimmer caps on all xtals**
- ☐ **Reverse Polarity protected**
- ☐ **Built-in speaker**
- ☐ **Electronic T/R switching – No relay problems**

Prices and specifications subject to change without notice.

SPECTRUM COMMUNICATIONS

P.O. BOX 140 ● WORCESTER, PA 19490

215-584-6469

Send for Spec Sheet

There's nothing amateur about our radios.

Deluxe "101 Series"... The ultimate base station combination.

YAESU DIGITAL RECEIVER FR-101
2 1 2 5 0.0
PHONES
RECORD
MODE
PRESELECT

FR-101 Digital

SOLID-STATE RECEIVER

- Total coverage capability: 160 thru 2 meters + 12 major S.W. bands.*
- Direct frequency readout to 100Hz.
- Provision for all-mode reception: SSB, CW, AM, RTTY & FM.**
- Reliable, plug-in, modular circuitry.
- Compatible transceive operation with 101 series.

* Six and two-meter converters and crystals optional. ** Filters and FM detector optional.

METER
ALL BAND SSB TRANSMITTER
YAESU FL-101
PLATE
LOADING
PRESELECT
VOX GAIN ⊕ ANTI TRIP
RF PROCESS
MODE
MIC GAIN ⊕ CARRIER
BAND
DELAY

FL-101

SOLID-STATE TRANSMITTER

- 240 Watts PEP.
- 160 thru 10 meter coverage + 2 optional auxiliary bands.
- All-mode operation: SSB, CW, AM & FSK.
- Reliable, plug-in, modular circuitry.
- Provision for RF speech processor.

Specifications subject to change without notice.

Visit your dealer for details or write for our new catalog.

All Yaesu products warranted by the selling dealer. Complete after-warranty service available in Paramount, Calif.

YAESU
MUSEN USA INC.

7625 E. Rosecrans Avenue, Unit #29 Paramount, California 90723 (213) 633-4007